Electrical Review

THE PIONEER ELECTRICAL WEEKLY OF AMERICA.

VOL. XXXVII. No. 11. NEW YORK, WEDNESDAY, SEPTEMBER 12, 1900. ISSUED WEEKLY.

ELECTRICAL REVIEW

Park Row Building,
13-21 Park Row, New York.
P. O. Box 2339.

CHARLES W. PRICE, Editor.
STEPHEN L. COLES, Managing Editor.
CHARLES T. CHILD, Technical Editor.
STEPHEN H. GODDARD, Advertising Manager.
RUSSELL HOWLAND, Assistant Advertising Manager.

Registered Cable Address:
"Electview," - New York.
Telephone Call, 1546 "Cortlandt."

Western Office:
FRANK E. COLBERT, Representative, 1612-1613 Marquette Building, Chicago.

Washington Office:
GEO. C. MAYNARD, Representative, Room 102 Washington Loan and Trust Building, Washington, D. C.

London Office:
HENRY W. HALL, Representative, 42 Old Broad Street, London, E. C.

News, Subscriptions and Advertisements.

Subscriptions to the
ELECTRICAL REVIEW.

One Year, United States and Canada, - - $3.00
One Year, Foreign Countries, - - - - - - 5.00
Single Copies, each, - - - - - - - - .10
Copies can be supplied for only one year back at 25 cents each.

OURSELVES.

It is a general principle that the man who boasts is lost. Still, like swearing, boasting is once in a while permissible and even desirable, and we think that this is one of the occasions that we should seize, not exactly to boast, but to impress upon other people our own faith in the future and prospects of the ELECTRICAL REVIEW.

We have found the last two years to be a period of unusual and continuous increase. The great activity of the electrical field, resulting in a condition of prosperity such as it has not enjoyed before for many years, has been reflected toward us in much the same measure that we have tried to picture it in our columns. The result has been that, like other enterprises in the electrical field, the ELECTRICAL REVIEW has grown and prospered and has found the necessity arising for enlargement of its force, of its resources and of itself. To do these things properly necessitated increased room and better facilities, which we have found in our new offices described in our last issue.

With this first number published from the new address, the ELECTRICAL REVIEW takes pleasure in calling the attention of its friends and readers to certain minor changes in its typography, and an increase in the number of its reading pages, and to assure them that no effort will be spared in the future—as none has been in the past—to make this journal representative of all that is best in the broad field of the electrical arts and sciences. It is with no little feeling of thankfulness that we testify to the kindly appreciation that we have found from our friends in these important avenues of activity. Without them it would have been impossible for us to grow, and impossible for us to do as we intend to do—give them a constantly better and better return for their investment in money and good will with us.

It will not, we hope, be considered improper for us to say here that it is proposed to make this journal the most representative and progressive exponent of its field printed in the world. This means no little hard work, but with the assistance of our friends in the electrical field we feel capable of making good the promise implied in the above remark, and shall spare no effort to extend the usefulness and multiply the resources of the ELECTRICAL REVIEW for their behalf.

THE IMPORTANCE OF THE EXPORT MARKET.

It is confidently expected that the full returns of the census of 1900 will show the population of the United States to be over eighty million people. Even with this enormous total, our population represents less than one-seventeenth of the total number of mankind, and this may be looked at as meaning that wherever there is one person to be fed, clothed or surrounded with the various appliances of civilization in this country, there are more than sixteen others outside whose claims upon our attention grow more and more important as we become better able to satisfy the demands of the world outside our own territorial boundaries.

Considering the volume of exports with regard to population, the United States now occupy fourth place among the nations of the world, having exported, three years ago, goods to the value of $14.74 per capita of their population. In the same year the exports, per capita, from the United Kingdom were valued at $29.25, or a little less than twice as much. Both France and Germany exceeded the United States in the per capita values of their exports.

It is now practically conceded that in general adaptability for their uses in perfection of electrical and mechanical design, in simplicity and perfection of workmanship, the electrical manufactures of the United States are the best in the world. No stronger testimony to this effect is possible than that offered by the action of municipal bodies in Great Britain who have bought our apparatus, often at higher prices than they would have been charged in their own country, and, after careful and conscientious study of the various systems offered, and, it is painful to say, most often in the face of bitter oppo-

sition at home. The fact that the majority of South American electrical installations are supplied with British and German apparatus is one that can not be pleasant to the American manufacturer, but, to a certain degree, he has his own lack of appreciation of the vast market exterior to the United States to blame for this condition of affairs. It has been demonstrated in every line of industry that the high cost of labor in the United States is more than overbalanced by the enormous productive capacity of the intelligent labor we enjoy, combined with the accurate and perfected machinery employed in nearly all mechanical operations. Notwithstanding that we pay more proportionately for work than is paid elsewhere, and that our raw materials not infrequently cost us more than similar goods are sold for in other countries, we are yet able to compete successfully in the markets of the world with our manufactured products. The reason for this is two-fold; it is found in the high productive capacity of the American mechanic and in the extraordinary perfection of machinery and methods of manufacture in this country.

Even in view of all these facts our electrical manufacturers are only now waking up to the fact that outside of the country exists a market and a perpetual demand for products practically measured by the population of the world compared with that of the United States. Of course, it can not be urged or argued that the demand for manufactures in China, for example, is commensurate with the vast population of the country. At the same time nothing is more certain than that the increase of civilization and the exploitation of new ideas there will, in time, produce a demand more and more in proportion to the numbers of the Chinese people. It is so elsewhere, and in Europe we find already the intelligent demand coupled with the ability to pay and pay well for what is wanted.

To encourage our exports two things need to be done. One of these is to present strongly to all external centres of trade the advantages and perfections of American-made manufactured products, and the other is actually to create a demand for the better class of goods in countries where such demand does not exist to-day. The method of securing export orders in France, for example, will naturally be entirely different from that adopted in India or China. In the one country we have intelligent appreciation and what may be called high consuming power; that is, the necessity for using manufactured products such as electrical machinery, is already evident, and the people to-day are looking for the best that can be had in that line. In the other country they do not yet know that they need such things, and education must precede the work of the salesman.

What we seem to need in the East, and in other little cultivated regions of the world, is a combination of the salesman and the missionary. While it is true that trade follows the flag, still trade can not always be extended by the direct and severe method of the Gatling gun and the twelve-inch shell. We need more than political or military ascendancy in a given region, perhaps much more than the "open door." We need missionary effort on the part of manufacturers who are willing to send men and goods to distant countries in order that their inhabitants may learn the advantages and values of things of which they are to-day in absolute ignorance. We have much to learn from our European competitors as to methods of securing export business. We must not forget that the foot, the pound and the dollar are as foreign to the Russian as the verst, the pood and the copeck are to us. We should not forget that in China green things are unlucky and yellow things are for the sole use of the Emperor and his family. We can not expect the Sultan of Sulu to appreciate the advantages of the electric light which he has probably never seen. To sum it all up, we must use intelligent and well-directed effort to secure the business which is knocking at our door, metaphorically speaking, and craving admission to our markets—provided we are willing to undertake the slight task of approaching it in the way it is accustomed to being approached. In no direction of effort and in no branch of manufacture are these truths more apparent than they are in the electrical arts.

THE WATER POWERS OF CANADA.

To this day Canada, although three hundred and sixty-five years have elapsed since Jacques Cartier sailed up the St. Lawrence in search of the coast of China, remains in many respects an undeveloped country. For all the years that it has been known and explored, and for countless thousands of years before, its mighty rivers have rushed headlong to the sea wasting an uncounted total of power that must ultimately be available for all sorts and manners of industrial enterprises. It is only lately that due attention has been given to the magnificent resources of this character which the country possesses, and now there is going on all over the provinces of Ontario and Quebec an awakening of interest in water-power stimulated by the capacity of modern electrical engineering to utilize and distribute the valuable power of the many cataracts contained in that region. The St. Lawrence is partly—and every American must regret that it is not wholly—an international boundary line, and upon it and its tributaries some of the most notable developments have taken place. On the New York side, at Massena Springs, a gigantic plant capable of producing 150,000 horse-power, is nearly finished. Further down the river, at Montreal, the Lachine Rapids plant has been in operation for several years to the great satisfaction of all concerned in it. Nearby, at Chambly, on the Richelieu River, is another fine plant, developing 12,000 horse-power, and further down at Three Rivers, is still another. At Quebec, the falls of Montmorency, celebrated in verse and story, have lately taken on the less poetical but more utilitarian attitude of turning water-wheels and generating electricity. These developments, as large as they are, have yet failed to abstract more than an insignificant percentage of the vast energy that is running to waste in the multitudinous cataracts of Canada. It is merely a beginning that has been made and the future that lies before the happy region blessed with such prodigal gifts of Nature in the shape of an abundant and inexpensive power is almost impossible to foresee.

It is pleasant to note that many of

these plants have been developed by American enterprise and that practically all of them have been made possible by the use of American-made machinery. Canada has fully waked up to the immense value of this variety of its natural resources. Against it may be placed only the inhospitable climate of the country, which, during certain months of the year, inevitably causes more or less trouble from ice in any hydraulic development. The fact that Canada has so appreciated its own resources should be an object lesson to certain regions equally well favored with respect to natural power and comparatively blessed as regards climate and situation.

For example, the state of Georgia contains as fine water-powers as are found anywhere on the Atlantic slope of North America. These powers are in a situation practically ideal as regards climate, transportation facilities, and abundant labor. Already they are beginning to be developed, but on a scale incommensurate with their possibilities. It is gratifying to know that in New York state no effort has been spared to take advantage of the extraordinary possibilities which nature has provided in the way of rapidly flowing and swiftly descending streams. New England is a country of water-powers, but so far there has been but little attempt to develop these electrically. On the Pacific coast, both of Canada and the United States, there are magnificent waterfalls simply awaiting a greater density of population in the country for a demand for their utilization as sources of power.

There seems no reason to think that Canada will not eventually be a great manufacturing country, if cheap power and an abundance of raw material can make a country great in that direction.

THE GUTTA-PERCHA SUPPLY.

It is safe to assert that if all the projects for new submarine cable lines were to be taken in hand at once, the supplies of gutta-percha available for insulation would prove seriously inadequate. But it is pointed out by Mr. Hawthorne Hill, in a contribution printed on another page, that many of the lines that have been proposed are not likely to be undertaken soon, while some of them may never exist, except on paper. Meanwhile, it appears that every legitimate demand for gutta-percha is being met by the constantly increasing rate of production, though at a marked advance in cost, as compared with the early days of cable building. How long the native supplies will hold out is a problem, and nothing has been done in the way of forming plantations. Mr. Hill, suggests, however, the possibility that immense quantities may be concealed in the vast East Indian jungles, which remain for the most part practically unexplored.

It has been noticed before that men of science have no nationality. To put it another way, the animosities which exist between ordinary people of different races and nations have no place in the makeup of the truly scientific and enlightened spirits who are the pioneers for the ever increasing industrial work of the world. Consequently nothing can be more pleasant than to chronicle the doings of an international assemblage of scientific men wherein the representatives of the various nations of the earth meet one another with the utmost amity and discuss matters of high importance with the greatest concord. Such a meeting is the International Congress of Electricians, held recently at the Paris Exposition, of which a full report appears elsewhere in this issue. In a way this gathering was noteworthy as bringing together a majority of the active spirits in electrical engineering of the several principal civilized countries of the world. The record of its deliberations may be read with interest, as they cover many of the more interesting questions before electrical engineers to-day.

Work on the equipment of the Manhattan Elevated Railway system in New York is rapidly progressing and it is expected that next Spring all of the lines will be in operation by electricity. By the middle of October two lines are confidently expected to be in operation. Among the interesting additions to the station equipment of these lines is the moving electric staircase or inclined elevator, which is now in operation under test at the Fifty-ninth street station of the Third avenue line. It is expected that these inclined lifts will greatly popularize the "elevated," especially with women, who seriously object to climbing the stairs at stations. It is on this account that a large portion of the traffic of the elevated railway has been diverted to the surface cars, although the fact that the latter lines stop their cars at all intersecting streets is doubtless responsible in a considerable measure for their popularity with shoppers, who do not wish to walk several blocks from an elevated station. The title of "Electric City," which has been claimed at various times by various municipalities in the United States would seem rightfully to belong to New York after the immense electrical improvements now under way are completed.

The wonderful extent to which the electric motor is used as a source of directly-applied power is not appreciated by those unfamiliar with the modern machine shop. There is scarcely any tool which can not be economically and efficiently equipped with a direct-coupled electric motor. Where the source of current is at a waterfall and efficient transmission is attainable the cost of the power delivered at the tool and the cost of operating the tool are remarkably low. In such a case the belt user has to take a back seat.

Woman's favorite way of preventing linemen from installing electric light or telephone poles is to wait until the pole hole is dug and then to get into the hole and thus prevent the raising of the pole. A woman is pretty certain in her own mind that the workmen will not attack her or set the pole on top of her. The episode has become so common that in a New York newspaper recently three occurrences of the sort were chronicled in the same issue.

The latest use to which the trolley car has been put is as an adjunct to political campaigns. In Chicago, a trolley ride was given to all the Republicans in a certain ward, who were taken around in a train of highly-decorated trolley cars, accompanied by a band and the glare of red fire. At frequent intervals the motormen stopped the cars and political orators held forth from the rear platforms.

The Electric Light and Power Plant of the Lachine Rapids Hydraulic & Land Company.

The Twelve Thousand Horse-power Hydraulic and Electrical Station That Lights Montreal and Furnishes Power to its Industries.—A Great Canadian Plant Equipped with American Apparatus.

BY CHARLES T. CHILD.

It was just three hundred and sixty-five years ago that M. Jacques Cartier set forth from St. Malo, in France, on a voyage in search of the Northwest Passage to China. Sailing into a mighty estuary he believed he had found the long-sought strait which would lead him to the waters of Cathay, and along it he sailed for about 600 miles. Long before he had reached a point so far inland he saw that he was sailing in one of the greatest rivers of the world, which he promptly named St. Lawrence, and finally his passage was barred by tremendous rapids, to which, possibly in derision, he gave the name of *la Chine* —China.

In the great work of the colonization of Canada, which began shortly after the adventurous voyage of Cartier, Lachine Rapids, proving an obstacle in the way of vessels sailing up the river, naturally marked the situation of a port of transhipment; so, on the island surmounted by Mont Royale, at the foot of the long slant of seething water, grew up in time, first the village and then the city of Montreal, which is now the financial and commercial metropolis of Canada.

To the accident of the rapids barring navigation in the river the city owes its location; to the enormous water-power of the same rapids, as developed and made useful by electrical means, the city in the future will owe much of a tangible and material kind, since these rapids furnish it with inexhaustible power easily and cheaply developed, and applicable to all of the multitude of uses to which power is put in the multifarious industries of a modern city.

It was long ago proposed to utilize some of the great power that was running to waste in the rapids so conveniently situated close to the boundary of the city. After several minor attempts had been made to seize upon part of the energy going to waste, a company was formed which proposed to develop, by means of a wing dam and a dam perpendicular to the northern shore of the river, a considerable amount of power to be utilized by mills and factories directly on the site or within a radius of a few hundred yards, the power being transmitted by line shafts or wire-rope systems. This project languished until the success attending power transmission by electricity gave new life to it, and it was then taken in hand by a company of sufficient financial strength and the project has been realized on a scale of

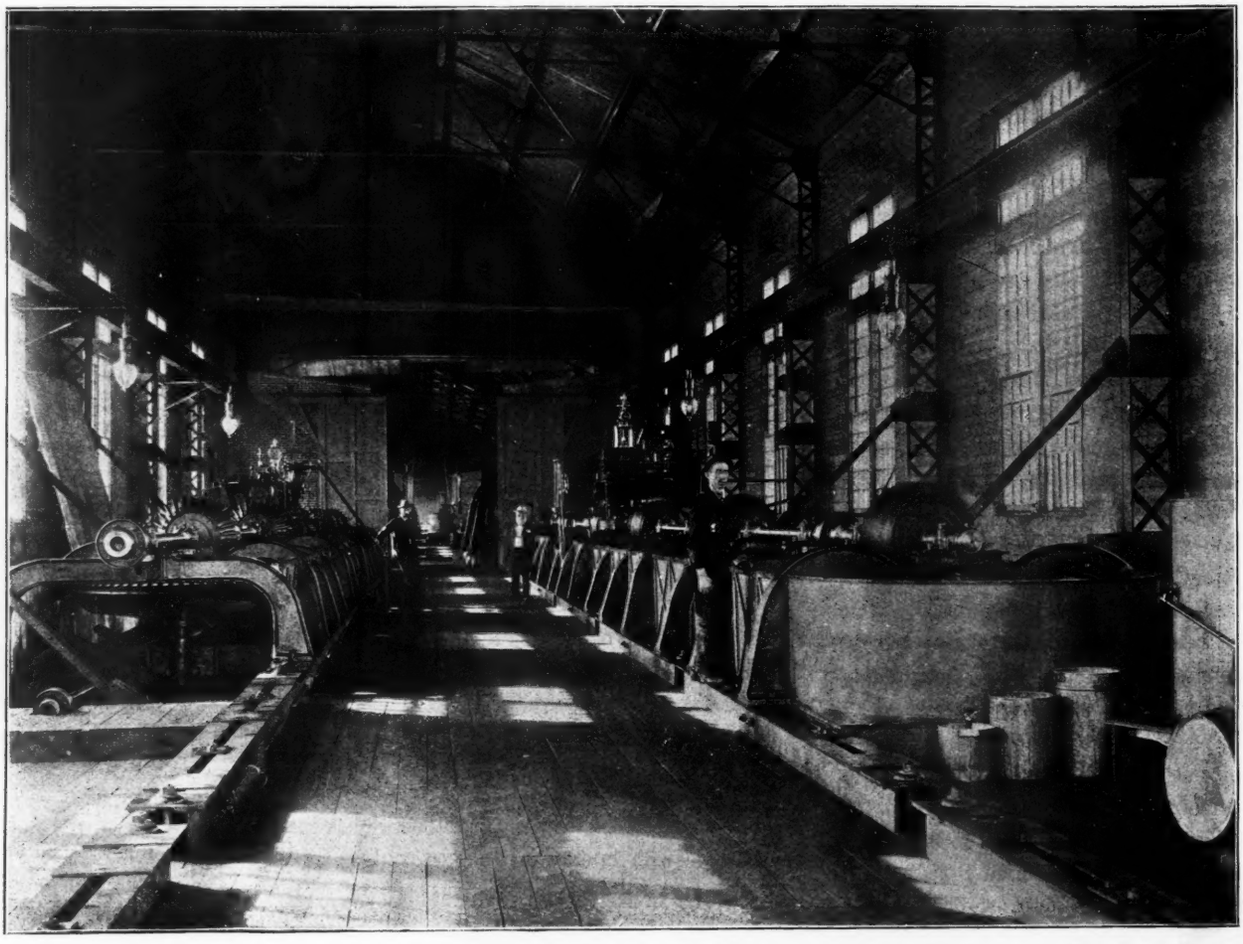


FIG. 1.—LOOKING ALONG THE MAIN AISLE OF THE LACHINE RAPIDS POWER-HOUSE, SHOWING GEARING OF TURBINES AND DYNAMOS IN DISTANCE.

great importance and in a manner reflecting high credit upon the engineers employed upon it.

The general situation of the Lachine power development may easily be understood by reference to the accompanying sketch map, Fig. 2. The St. Lawrence is divided by a long, narrow island at a point above the city into two channels, in both

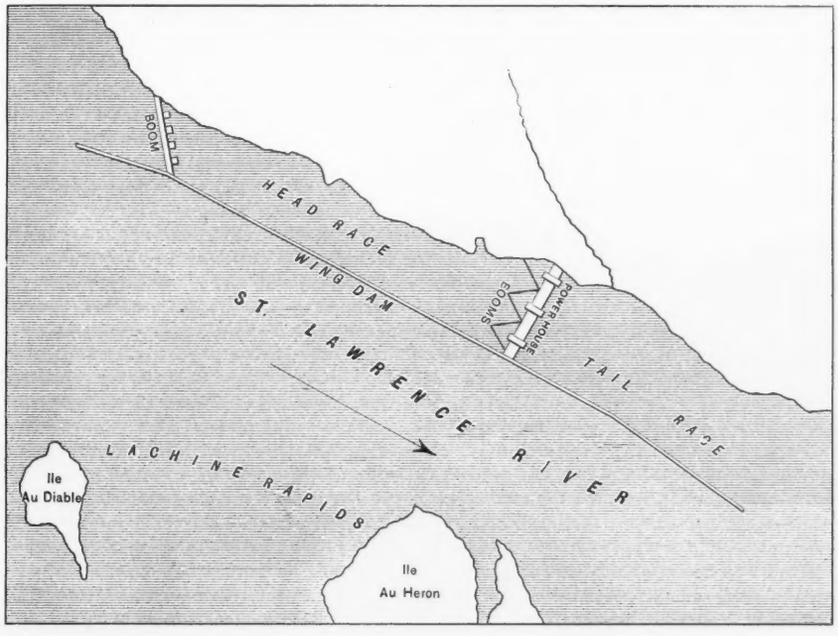


Fig. 2. Sketch Map of Lachine Rapids Power Development.

of which the flow is exceedingly rapid under a fall averaging 20 to 25 feet per mile. The two streams, taken together, are known as the Lachine rapids. It is in the smaller or northern of the two streams that the power development has been made. Parallel with the shore there has been erected a dam about one mile long, solidly constructed of crib work, ballasted with broken rock and filled with smaller materials, such as slag and clay, and covered with stone. In the channel formed between this long dam and the shore, the distance between the two being about 1,000 feet, the channel has been deepened, and across the canal thus formed is built a solid masonry dam upon which is located the power house. The total available fall varies up to about 16 feet and necessarily a very large amount of water is required to develop the great power produced by the 72 turbines of the installation. The forebay or upper part of the canal, formed by the two dams and the shore, is about 4,000 feet long, 1,000 feet wide and 13 feet deep, and through it the velocity of the water, under the full draught of all the wheels, is two feet per second.

The turbine wheels are 72 in number, each being a vertical shaft, cylinder-gate wheel, 54 inches in diameter and developing normally, with 14-foot head, about 300 horse-power.

The wheels are set in flumes, the wheels resting on wooden floors communicating with the tail race by means of short steel draught tubes.

The shafts of the wheels ascend through the flume and transmit power to the dynamo shafts by means of crown gears and pinions.

Secured to the yokes are sheet-iron protectors which are easily movable, their object being to prevent the gears throwing oil on the floors, and, at the same time, a protection for the public and the employees.

There is no floor on the flume over the wheels so as to prevent all possibility of fire from a hot box or journal on the wheel shaft.

All of the hydraulic power work was done by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, who supplied and installed the wheels and their accessories. By referring to Fig. 1 an excellent idea of the method of connecting the wheels and the dynamos may be had, this figure being a view taken from the middle of one of the wheel sections of the power house looking towards and into one of the dynamo rooms and showing two batteries of wheels and the shafts connecting them to two dynamos.

The wheels are set in sets of six in two rows, all six of each set driving by bevel gearing a single shaft which is direct-coupled to the revolving field of one of the dynamos. A single governor controls the gates of all six wheels, the driving being accomplished by means of a wooden tooth gear on the wheel shafts meshing with cast-iron pinions on the horizontal line shaft which runs to the dynamo. Fig. 1 gives an excellent idea of the construction of the shaft bearings and the line shaft, the size and proportions of a portion of the gearing being well shown on the left hand side of the illustration.

The governors used on the water-wheels are of two types; one is known as the Giessler electro-mechanical governor and is built by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio. This instrument is shown on the left-hand side of Fig. 7. Its operation is exceedingly ingenious. A small ball governor operates electrical contacts so that if the wheels speed up contact is made which through a relay throws current from the exciter circuits into one side of a mag-

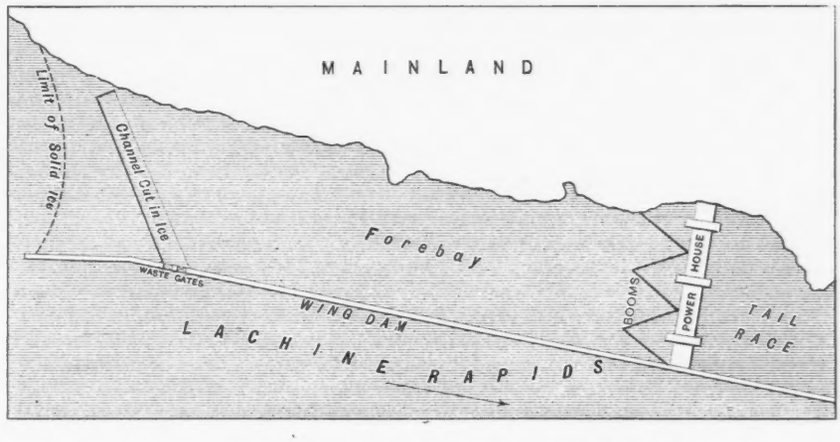


Fig. 3.—Showing Limit of Freezing in the Lachine Rapids Forebay.

netic clutch clutching a worm gear arrangement to the main line shaft and closing the gates of the six wheels. If the wheels run too slowly the other contact is made by the governor and a clutch on another side is thrown, connecting the

same mechanism through gearing so that its motion is reversed and the gates are opened. The other variety of governor is also illustrated in Fig. 7 and is known as the Lombard governor, manufactured by the Lombard Water Wheel Governor Company, of Boston, Mass. In this instrument the motion of the governor proper controls a small and delicately balanced valve which in turn controls a larger valve admitting oil under high pressure to a cylinder, the piston of which is directly connected with the gates of its set of wheels. Pressure upon the oil is maintained by a pump forming a part of the apparatus and it is claimed that its action is exceedingly sensitive and at the same time astatic, the governor being dead beat in its character and not "hunting" until a proper speed is found.

A highly ingenious system of signals is used between the switchboard and the governor stations in the wheel rooms. When a machine is being brought into circuit signals are exchanged by means of colored lamps between the control table in front of the switchboard and the wheel station, these signals being wired on a system resembling that of the engine room telegraph of a steamship, so that a signal must always be repeated back to the sender before it can be obeyed. This system as well as many other of the ingenious devices in use at the power house and substations is the design of Mr. R. S. Kelsch, the general superintendent and electrical engineer of the company.

The power house is a brick and steel structure 1,000 feet long and of varying widths; it contains three bays in which the dynamos are installed, and four long rooms such as the one shown in Fig. 1, in which the shafting and gearing of the wheels are placed. This construction enables the dynamo rooms to be shut off by doors from the gearing rooms and reduces the problem of heating the building in Winter, which is a serious one, to its lowest terms. The heating is entirely electrical, each room being supplied with coil heaters. In all, the design calls for 12 dynamos, each of 1,000 kilowatts, and of these eight are now installed and the other four are in process of construction. The building is provided with a hand crane running its entire length; at the northern or shore end it is finished by a tower several stories in height, from which the transmission line takes its departure.

Before proceeding further with the description of the power house machinery, it is well to consider the peculiar conditions surrounding water-power operation, in a Canadian climate.

While the rapids never freeze, the water is encumbered with anchor ice and frazil.

Anchor ice is ice that is formed on the bottom of the river. It forms in any water that is too swift to freeze over. It accumulates at considerable depths and in large quantities, when the temperature stays for any continued length of time from 10 to 20 degrees below zero.

Frazil is composed of fine needles of ice, which are formed in water which is agitated, and will stick to any substance it meets with, like wood or iron, somewhat in the same manner as iron filings will stick to a magnet. It will not form in still water, nor under cover.

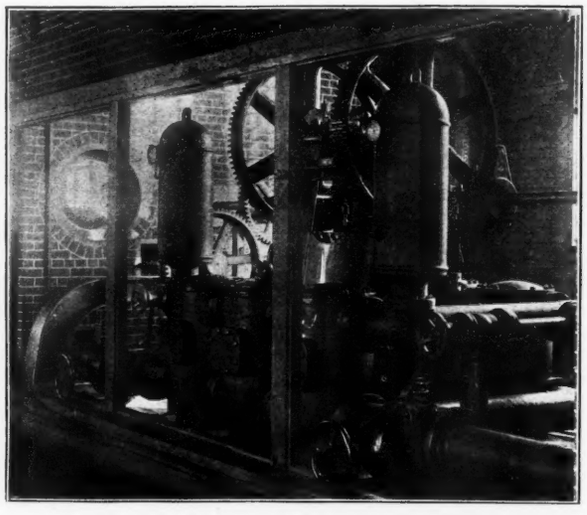


FIG. 6.—FIRE-PUMPS IN THE LACHINE RAPIDS POWER-HOUSE.

The Lachine Rapids Company gets rid of the anchor ice by the fact of having a large wide and deep basin of still water which freezes over in the early Winter and prevents the formation of anchor ice and frazil. It is only therefore necessary for it to get rid of this ice, which is formed in the open waters above the site of its works.

By reference to Fig. 3 it will be seen that the main dam upon which the power house is built, is provided with booms. The object of these booms, is to deflect floating material, chips, etc., down the forebay, through the waste weirs, into the tail race and thence down the river. They will also move shell ice that may be broken by the wind in the Spring or Fall.

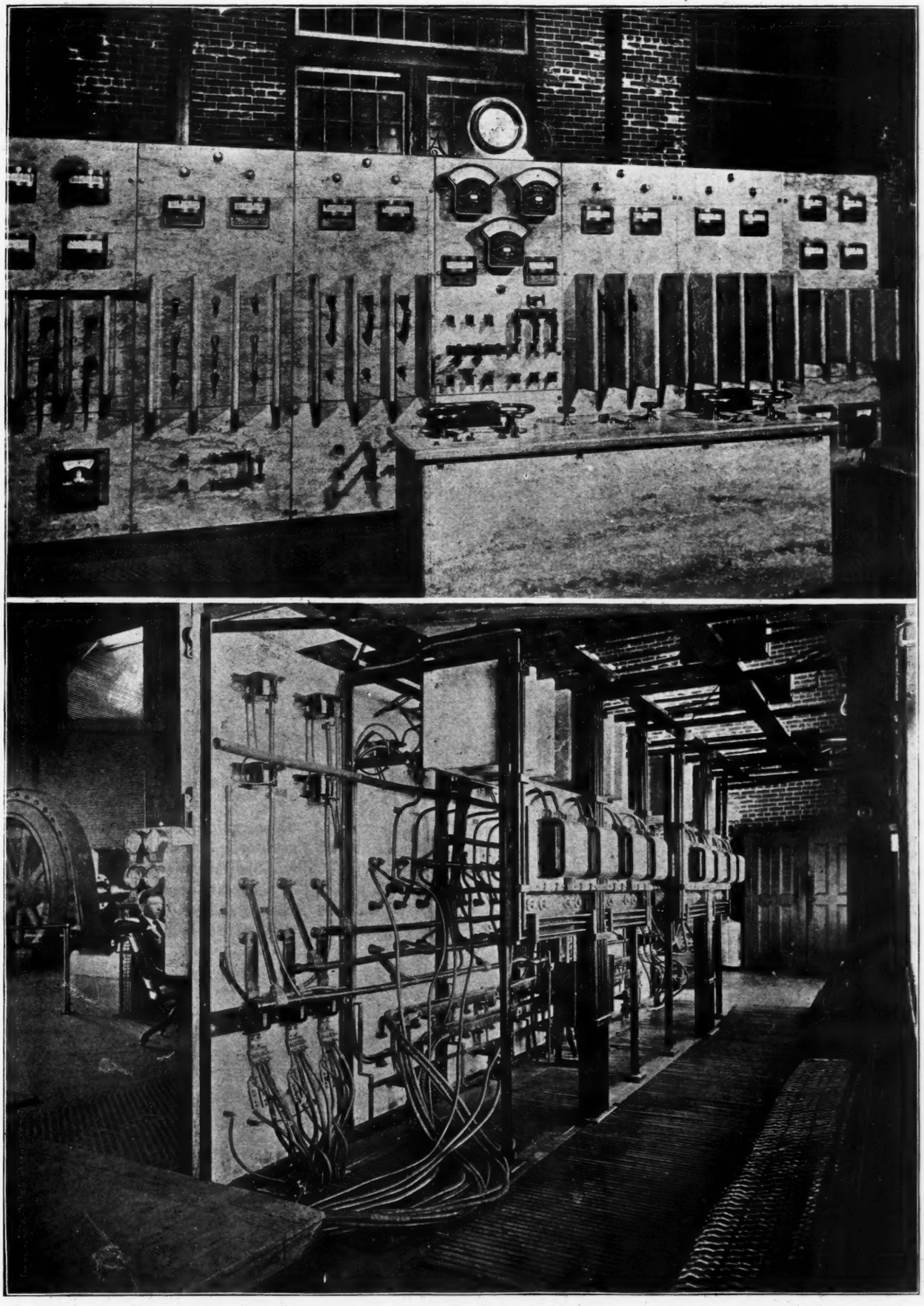
Owing to the situation at the upper end of the head race, the ice freezes across it, somewhat as shown by the dotted line in the map. There is a boom attached to the shore, at a point further up, which aids in deflecting floating ice as far as possible into the river and prevents a large portion of it getting into the head race.

During the past year, improvements have been made in the works, which it is hoped will entirely eliminate all further troubles from anchor ice. The wing dam has been raised so as to destroy the overflow. This will naturally reduce the current at the intake to a minimum. In addition to this, two or three sluices have been left in the wing dam which, should occasion require it, may be used for ridding the head race of any anchor ice that may be forced into the head race when the river above is completely blocked with ice.

During the last Winter the company suffered no inconvenience from ice, although the works above referred to were not completed. Temporary sluices were placed in the then existing dam and any anchor ice that did come in the head race was got rid of by these sluices.

So far as the Lachine Rapids plant is concerned, it has never suffered any inconvenience by freezing up the rack or wheels, which is the trouble with most water-power plants. The inconvenience that it first suffered was the choking up of the intake, thereby reducing the water and causing the drawing down of the head.

Returning now to the power house, each battery of six wheels is direct-coupled to a generator of the three-phase type having revolving fields, the machines having been built by the General Electric Company. These machines have 40 poles wound up with strap copper laid edgewise, the fields absorbing up to 150 amperes at 150 volts according to



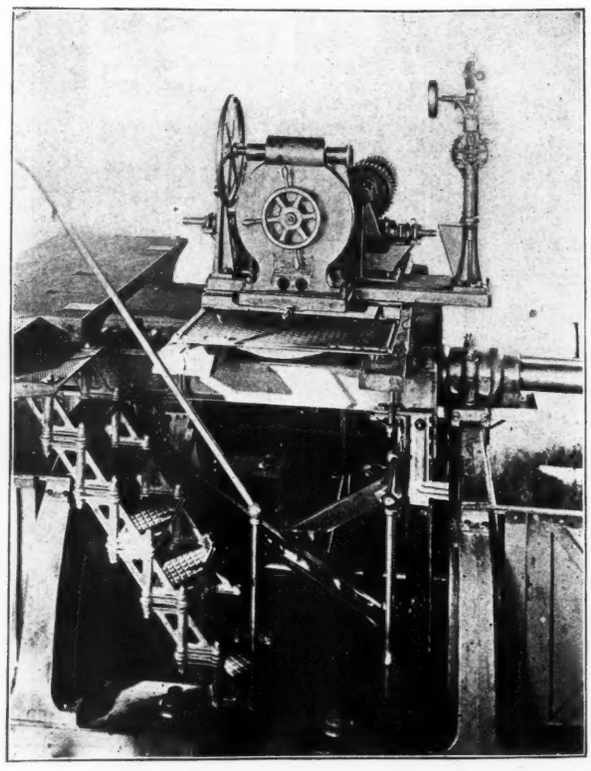
FIGS. 4 AND 5.—FRONT AND REAR VIEWS OF THE PRESENT TEMPORARY SWITCHBOARD IN THE LACHINE RAPIDS POWER-HOUSE—ELECTRIC HEATER SHOWN IN RIGHT FOREGROUND OF FIG. 5.

the load imposed upon the machine. Each is of 750 kilowatts capacity, running at 175 revolutions per minute and generating three-phase currents at 4,400 volts in each phase. The winding is of the usual wire-coil type and is arranged in one slot per pole per phase. The exciting current is led to the revolving field by means of two broad cast-iron collector rings upon each of which four heavy carbon brushes bear. All of the field coils are connected together in series. All the wiring from the dynamos to the switchboard is under the floor, cables manufactured by the National Conduit and Cable Company, of New York city, being used for this purpose as well as for the large amount of underground construction on the transmission line and on the distribution lines in the city of Montreal and its suburbs. The exciters were formerly belted to a pulley on the dynamo shaft, each dynamo being furnished with one exciter; this arrangement has been replaced by groups of exciters collected in rooms, two to a room and each pair driven by an independently governed water-wheel. The exciters are of the General Electric Company's standard type each giving 75 kilowatts at 150 volts when running at 660 revolutions per minute. The machines are compounded for constant voltage and are made with exceptionally large and heavy commutators; they are of a four-pole type and present no extraordinary features. There are at present two pairs of these exciters in the power house, each machine being able to take care of three dynamos.

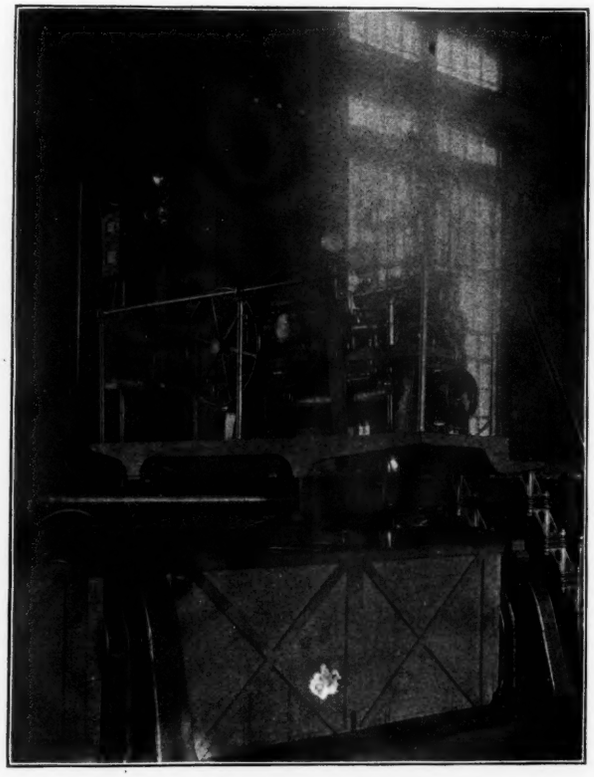
Figs. 4 and 5 show respectively front and rear views of the present temporary main switchboard, the former showing one end of the controlling table. The board is in seven panels, each 36 by 62 inches with subpanels of 28 by 36 inches, all mounted on slabs of blue Vermont marble two inches thick. Between each of the knife switches controlling the various phases of the various circuits is a projecting marble slab one and one-half inches thick coming out from the face of the board about 10 inches and effectually obviating any danger of a short circuit caused by arcing at one of the switches.

Each machine panel contains three knife switches, one in each phase, and alternating-current ampere meters as well as three-phase lamps used in bringing the machines into parallel with one another. The middle panel is the exciter panel. It will not be necessary to describe the operation of this board in any detail as it is shortly to be replaced by another which will contain a different arrangement of apparatus. The alternating current indicating instruments on the face of the board were manufactured by the Wagner Electric Manufacturing Company, of St. Louis, Mo., the three large meters of the exciter panel being of the Weston type.

The back of the board even in its present arrangement is of exceeding interest. The bus-bars are of copper cable covered all over with hard rubber tubing and



The Giessler Governor.



The Lombard Governor.

FIG. 7.—TWO TYPES OF WATER-WHEEL GOVERNORS IN THE LACHINE RAPIDS POWER-HOUSE.

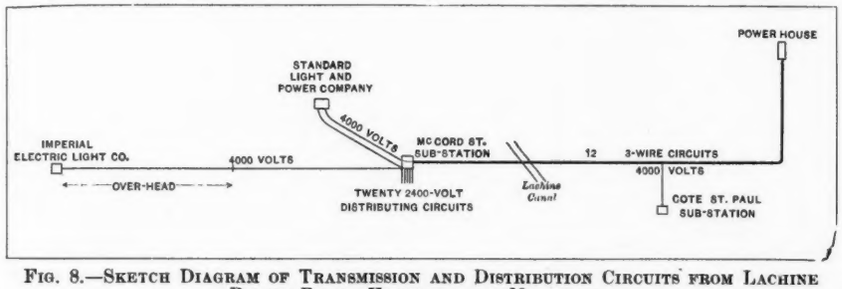


FIG. 8.—SKETCH DIAGRAM OF TRANSMISSION AND DISTRIBUTION CIRCUITS FROM LACHINE RAPIDS POWER-HOUSE AND IN MONTREAL.

caps. There are two sets of these bars and any machine may be thrown upon either at will as may any of the transmission circuits to the city. In this way practically any combination of machine and circuit can be made. The exciter fuses are made of aluminum sheet. Fig. 5 gives an excellent idea of the arrangement of the back of the present temporary board, showing its construction in detail. As in other parts of the high-tension equipment of the station, men working on this board have wooden gratings to stand on and the utmost care has been taken to insulate thoroughly every part carrying the high voltage. On the new board which is to replace this one there will be no high-tension current on the face of the board. The switches of the knife type shown in Fig. 4 are operated by hooks on the ends of wooden sticks about four feet long, this being regarded as better than providing each switch with handles. From this switchboard circuits are led to a distributing switchboard in the base of the tower at the front of the building. In the tower also are installed the lightning arresters which are of the Wirt 5,000-volt type. These are connected in delta between the three phases and each of the three wires of each circuit is also grounded through a lightning arrester thus securing very perfect and well distributed protection. All of the lightning arresters used are carefully tested and calibrated before being put into position.

FIG. 9.—THE LACHINE RAPIDS AND THE HEAD OF THE WING DAM,

The equipment of the main power house is completed by a machine shop driven by a five horse-power induction motor and sufficient to care for repairs on the station apparatus. In two of the bays of the power house are installed powerful fire pumps, well illustrated in Fig. 6. These pumps are of the triplex pattern built by the Goulds Manufacturing Company, of Seneca Falls, N. Y., each having a capacity of 1,000,000 gallons per day and operating up to a maximum pressure of 150 pounds per square inch. The pumps are driven by a clutch from the rear end of one of the dynamo line shafts and are connected permanently with lines of hose and pipe led all over the large station. Water pressure can be put on in a few seconds after an alarm of fire is given and the volume of water available is sufficient to drown out instantly any conflagration that may start in the power house.

The transmission line and substations are shown in diagram in Fig. 8. From the power house a line 32,000 feet long is laid to the main substation or distributing station at the corner of McCord and Basin streets in the city of Montreal. Tapped off from this line at an intermediate point is a short line reaching another substation known as the Cote St. Paul station, wherein are installed two synchronous motors, each driving two 125-light direct-current arc machines.

At McCord and Seminary streets, in the city of Montreal, is located the substation, where the main switchboard of the company will be located, dividing the power up into various units, as occasion may call for. The switchboard will be, when completed, one of the finest in America. It will be contained in a fire-proof vault, which has just been constructed. Wires will enter and leave this building underground. A fire-proof transformer house will also be constructed adjoining the sub-station, land for which has recently been acquired.

The transmission line to the McCord sub-station consists of 12-three-phase lines —in other words, of 36 wires on the overhead part—all of them of No. 0 copper, mounted on triple petticoat porcelain insulators carried on 4 by 4 inch wooden cross-arms on steel poles. These poles are built up of four steel angle-irons, riveted together with latticed strips between,

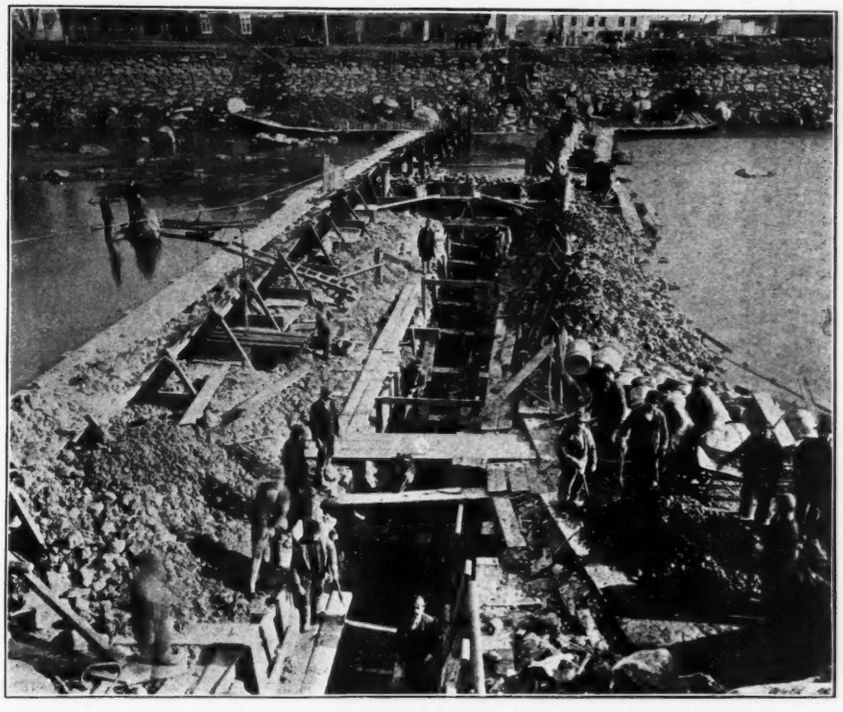


FIG. 10.—LAYING THE CABLES UNDER THE LACHINE CANAL.

and are set securely in concrete, the poles being 29 feet high out of the ground. These 12 lines are normally all operated in parallel, though they can be sub-divided in any way desired. At the McCord street station this current is received by three 150-kilowatt oil transformers having water-cooling pipes in the oil and transforming from 4,000 to 2,000 volts. There are also three, and one reserve, 250-kilowatt transformers, working from 4,000 to 2,300 volts, and arranged for water cooling or for self-cooling. Each set of the transformers is at present controlled by a 150-ampere General Electric Company's oil-brake switch on the high-tension side. There are also three transformers 4,000 to 225 volts, of 30 kilowatts each, of the self-cooling oil type, used as boosters, their secondaries being connected in series with the secondaries of the 150-kilowatt transformers described above. All of these instruments are tested to 25,000 volts from coil to coil and from each coil to the case for 30 minutes before acceptance, all of the smaller transformers used in the work being subjected also to a similar test. They were built by the Wagner Electric Manufacturing Company, of St. Louis. The bus-bars at the sub-station are in duplicate, the lines connecting them through switches in each phase and high-tension "expulsion" fuses. Where the transmission line crosses the Lachine canal, at a point near the McCord station, it is carried under on cables made by the National Conduit and Cable Company, of New York, laid in a conduit under the canal at a depth of 33 feet below the water level. All lines enter and leave the sub-station in similar cables, and connect to double-throw switches by which any line may be thrown either to the power or lighting bus-bars. Every cable is in a separate duct everywhere in the sub-station in order to avoid, as far as may be, any danger of a short circuit which, under 4,400 volts, would be highly destructive. This sub-station supplies 20 2,400-volt distributing circuits which radiate all over a large district of the city, and also supplies one 4,000-volt circuit to a station known as the Imperial Electric Light and Power Company's station in the eastern end of the city, where the current is used to operate synchronous motors driving the electric light machinery, and two circuits to the plant of the Standard Electric Light and Power Company, where one is transformed to operate two rotary converters feeding a 500-volt, three-wire, direct-current motor circuit in the heavy business portion of the city, and the other operates a synchronous motor for driving arc lighting and other dynamos. These 4,000-volt lines are tested at the sub-station through two sets of 30-kilowatt transformers in parallel with one another, but in series with the line, the amount of boosting being 350 volts.

The distributing system originally contemplated using oil-insulated transformers in manholes and having only the secondary system on pole lines in the city. For various reasons this has been changed so that now all of the transformers are on poles, generally in alleys, the underground conducting cables being laid up the poles to the transformers. It is probable that hereafter all of the transformers used will be of the oil type, though at present some of the dry type are in use. Some trouble has been found in the operation of the system with water in the oil, which seems to be in a degree hygroscopic. By a new arrangement introduced by the superintendent this difficulty, it is hoped, has been obviated, at the same time the oil being allowed to expand with variations of temperature. Petroleum of 300 degrees fire-test is used as the insulating oil. On account of the extended nature of the city and the many trees it contains, the secondary net-work is of unusual size. It is maintained at 110 volts and small induction motors are fed at this pressure, the larger ones generally employing the 2,000 volts current of the intermediate distribution. The load on the company's system at present is about 75,000 incandescent lamps, and between 2,500 and 3,000 horse-power in motors, both synchronous and induction. In general, flat rates are made, though there are some meter customers; but the question of charges is one that is in a chaotic condition in Montreal on account of severe competition in the electric lighting industry there.

The original engineering design of the plant is due to Messrs. Thomas Pringle & Son, and Mr. W. McLea Walbank, hydraulic and mechanical engineers. The present operative design of the plant and the design of the new features which will shortly be incorporated in it, as well as of all the elaborate switchboard work that is in contemplation, is due to Mr. R. S. Kelsch. The company, whose official title is the Lachine Rapids Hydraulic and Land Company, Limited, is owned almost entirely in Montreal. In the future certain other large plans for water-power and electric development will be carried out by the same concern, which has already formulated plans for a considerable extension of its work both in Montreal and elsewhere in the Province of Quebec.

FIG. 11.—SOME OF THE LACHINE TURBINES WAITING TO BE INSTALLED.

A Mexican Electric Power Plant.

The work of constructing one of the most extensive power-producing plants in Mexico is now in progress in the State of Chihuahua, located on the San Juan branch of the Concho River. The company was incorporated several months ago, according to the laws of the United States, in the State of Illinois, with a capital stock of $1,000,000, gold, a former United States Consul at Chihuahua being the promoter. The undertaking includes the construction of a dam in the river named between the city of Peral and Chihuahua. This dam is to be 250 feet wide and 150 feet in height, which, it is believed, will form a lake in the valley 15 miles long with an extreme width of three and one-half miles. The electric power generated by the waters of this lake will be transmitted to Peral, 40 miles away, and to Chihuahua, 80 miles distant. The system is so planned that connecting cables can be run from the main lines in any direction, and whatever amount of power is desired by their enterprises can be delivered at a reasonable cost. From 6,000 to 10,000 horse-power has already been contracted for in the two cities directly interested.

Officers of the Edison Association of Illuminating Companies.

The annual election of officers for the ensuing year of the Association of Edison Illuminating Companies, at Saratoga Springs, N. Y., September 6, resulted in the selection of the following-named gentlemen:

President, John W. Lieb, Jr., New York.

Vice-president, A. W. Field, Columbus, Ohio.

Treasurer, W. S. Barstow, Borough of Brooklyn, New York.

Secretary, Wilson S. Howell, Newark, N. J.

Executive Committee: John W. Lieb, Jr., president, chairman; Alex. Dow, Detroit, Mich.; Charles L. Edgar, Boston, Mass.; W. C. L. Eglin, Philadelphia, Pa.; Samuel Insull, Chicago, Ill.; T. E. Murray, New York, N. Y.; and as *ex-officio* members, A. W. Field, W. S. Barstow and Wilson S. Howell.

A special committee, composed of Messrs. Samuel Insull, Charles L. Edgar and Hoyt Post, was appointed to prepare resolutions, later to be incorporated in the minutes, expressing the great loss to the association by the death of Mr. S. Dana Green.

The Committee on Welsbach Light and Acetylene Gas was discharged from further consideration of the subject, the meeting evidently being of the opinion that the special interest in these subjects had ceased for the time. An additional committee was ordered appointed, to be known as the Committee on Standardizing of Switches and Similar Apparatus; the duty immediately assigned to this committee being the correlation of the practice in respect of the smaller switches and cutouts used by the member companies.

Before adjournment a group picture was taken, which is reproduced in the ELECTRICAL REVIEW herewith.

The association visited the General Electric Company's works at Schenectady, N. Y., on Friday, September 7, and were most pleasantly entertained.

GROUP OF DELEGATES TO THE RECENT CONVENTION OF THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES, AT SARATOGA, N. Y.

A German Automobile Plow.

United States Consul-General Guenther sends the following from Frankfort, Germany: On July 25 the motor factory of Oberursel, near Frankfort, exhibited in the presence of a number of experts its new alchohol plow locomobiles. The plow locomobile is a 20 horse-power one, and confidence is expressed by competent judges that coal can, in some cases, be substituted by alcohol, which can be procured everywhere and at low cost. The alcohol plow is said to have performed its work fully as well as a steam plow operated simultaneously. The problem of using alcohol for power purposes has been solved by the motor factory in evaporating denaturized alcohol of 90 degrees. The construction and operation of the motor is, after this gasification, the same as that of a gas motor. The machine uses about a pint of alcohol an hour for one horse-power. It is claimed that the operating expense is 25 per cent lower than that of steam plows.

The International Electrical Congress at the Paris Exposition.

Complete Report of the Meetings of the Five Sections, with Papers Read and Discussions.—List of Those Present.

BY C. L. DURAND.

The Electrical Congress of 1900 was formally opened on August 18, in the Palais de Congrès at the Paris Exposition. A large number of delegates were present, representing English, American and European electricians. The large tribune at one end of the hall was occupied by the official delegates of the different governments and scientific societies.

The congress was presided over by M. Mougeot, sub-secretary of state of thePostal and Telegraph Department. M. Mougeot delivered an address in which he expressed the pleasure given to him by the honor of presiding at the opening meeting of the congress. He realizes what eminent men compose this body, and that they are the disciples of science, which is the pioneer of civilization, and of which electricity is one of the most marvelous applications. He welcomes the foreign members who have come to Paris, and salutes them in the name of the French Republic. The address of M. Mougeot was warmly applauded.

M. Mascart, president of the organization committee of the congress, delivered the principal address of the session, which is given *in extenso* as follows:

ADDRESS OF M. MASCART.

The organization committee has a particularly agreeable duty to fulfill—that of expressing its profound gratitude to our foreign colleagues for the zeal with which they have come in such great numbers in response to its invitation. We hope that this congress, in bringing together the scientists and engineers of the different countries which have directed their efforts toward the progress of electricity will contribute to strengthen the ties of friendship formed in the previous reunions and to create new relations among them.

The applications of electricity extend, at the present day, to nearly all the branches of human activity. At the beginning of the century, Napoleon, then First Consul, after having assisted at the experiments of Volta before the Institute of France, expressed the opinion that this department of physics appeared to lead the way to great discoveries. No prediction has been more completely realized. The discoveries which have followed each other since that time present a unique character in the history of human intelligence.

The first task was to put in evidence the principles and laws of electric currents; this was accomplished in 30 years by the work of Oersted, Ampere and Faraday. At the same time, Davy showed, by memorable experiments, the resources which were to be found by chemistry, Jacobi founded the important industry of galvanoplasty, and the discovery of Arago of the magnetization of iron by electric currents gave birth to the electric telegraph.

The utilization of the new agent for motive power and the production of currents by mechanical means made much slower progress. If the problem was solved in principle, the practical solutions offered the greatest difficulties. For some special applications, the alternative direction which the movement of mechanical organs gives naturally to induced currents did not present any serious difficulties, but it was desired especially to rectify these currents to preserve the same direction at the exterior of the machines, by analogy with those given by the pile of Volta, and the second third of the century did not suffice to find a solution entirely satisfactory.

It was then that the little machine, too much ignored, of M. Paccinotti, and the invention of the industrial dynamo of M. Gramme, opened an entirely new route.

The spectacle which we have before our eyes to-day belongs to the domain of the marvelous. In place of the small laboratory apparatus and the cumbrous material of the voltaic batteries, we see machines of all dimensions, capable of performing the most delicate operations and of absorbing the work of the most powerful mechanical motors with an ease which defies all comparison. The entire industry is thus transformed.

The forces in reserve in nature find every where a better utilization. The rivers, torrents, cascades are put to use by electricity for the needs of man, either on the spot or at great distances, and the immense resources which were before lost are now utilizable. If the lovers of solitary landscapes may regret, at times, that the industry invades the wild or graceful valleys and takes possession of picturesque sites, these complaints can not be justified when compared with the benefits to the human race.

Electricity has made also a veritable revolution in the industry of transportation. It multiplies the relations between the inhabitants of cities and the communications between different localities. In a neighboring country (Switzerland), so beloved by tourists, it conducts to the most elevated peaks the visitors desirous of enjoying, without fatigue, the grand aspects of nature.

At the exposition of 1881 William Siemens showed us, for the first time, a curious experiment upon the refining of iron in a crucible between the carbons of an electric arc. The operation was made upon only a kilogramme of matter and one could scarcely predict that this electric furnace had so great a future before it.

The powerful means offered by electricity, industrially produced, has been taken advantage of by chemists for the economical production of aluminum and the rare metals, for the refining of copper, the direct formation of different substances, and the formation of a series of new bodies, to such a degree that one of the masters of the science was enabled to say: "The science of inorganic chemistry, which appeared to be finished, is only in its beginning. In this domain, also, science has rendered to industry, with usury, the services received from it."

Electric lighting no longer needs to demonstrate its special qualities in order to conquer the public favor; it develops constantly every day, and the exposition shows us with what magical effects this light adapts itself to the most marvelous effects of decoration. Electricity may even claim to have been the origin of one of its most recent rivals, the acetylene light, whose place is not yet well determined in the general economy.

For the exchange of human thought, the telegraph and telephone make continual progress from day to day. The increase of transactions has led to the invention of the most ingenious methods for multiplying the capacity of the lines and for utilizing the same wire for the simultaneous transmission of several messages, in the same or in contrary sense, leaving to the receiving apparatus the care of separating the signals in their proper circuits.

Metallic conductors have even been suppressed, entrusting to the air the care of transmitting the electric waves. Shall we see the time when the atmosphere, thus charged with an electricity quite different from that of storms, shall be traversed in all directions by artificial waves, invisible messengers, without disturbing each other, in the same manner as the rays of light which propagate themselves in the ether?

But the telegraph no longer suffices for the somewhat feverish activity of our time. The telephone itself causes considerable impatience and becomes powerless for very long distances. But now words are inscribed upon a steel wire, which repeats them in turn; soon we shall have telephonic relays which will permit the transmission across the continents of commercial messages and we will also hear the voices which are dear to us. What remains to be desired, if not to see at a distance? In spite of the complaisance of electricity, it would be perhaps too much to ask of it a miracle of this kind.

I have only been able to indicate in the main lines the principal applications of electricity. There remain to be mentioned the results obtained in physiology and medicine where the use of currents of high frequency has not said its last word; also the properties, yet mysterious, which are presented by the rays emitted by Crookes' tubes and by certain chemical compounds. In this field of investigation there remains a great deal to be done, and our present views of the constitution of matter will no doubt be singularly modified by this research.

Such is the immense domain in which you will necessarily be obliged to make a choice for your deliberations. At the time when the century arrives at its close, it is allowable to cast a backward glance over the route passed over. The most eminent minds have applied their genius to the study of electrical phenomena, and an army of engineers has followed to turn them to practical account.

Electricity has penetrated into every industry, suppressed distances, crossed the oceans and united nations; it will play an essential role in the realization of the general dream of bread and fraternity which ferments among all the civilized nations. An entire century for the accomplishment of this work seems a great deal for the contemporaries, but it is very little in the history of humanity. When our descendants are called upon to judge the nineteenth century, they will feel, no doubt, a sentiment of surprise and admiration in admitting that so many things have been accomplished in one century.

Permit me to terminate by a personal remembrance. In 1881, not far from this place, was held the first congress of electricity, which united the most illustrious savants of the entire world. It is not without emo-

tion that I recall that many of their number have disappeared, and I wish to render a testimony to their memory. There were seen among others: for Germany, von Helmholtz, Clausius, Kirchhoff, Du Bois Reymond, Wiedemann; for Great Britain, Spottiswoode, Hopkinson, Hughes, William Siemens; Mach, for Austria; Rossetti, Govi, Ferraris, for Italy, and many others, the list of whose names would be too long.

In the celebrated Commission of Units, that areopagus was presided over by J. B. Dumas with an authority and a distinction that imposed respect. He appeared to us like the last representative of a former generation, that of the great founders of the science, whose names were, for us, surrounded with a kind of aureole. It is due to a general spirit of conciliation and to the common desire to carry out a useful work that, under the influence of Dumas, the commission finished by a unanimous vote of the resolutions which have rendered such great service to science and industry.

I should like to open the present congress under the auspices of the congress of 1881, henceforth historic, in expressing the conviction that to-day, as then, your deliberations will be inspired by the same sentiment of conciliation, of concord and of sentiment of the public good.

The address of M. Mascart was warmly applauded. A recess of ten minutes was then taken in order to allow the members of the congress to confer as to the organization of the executive committee. When again assembled, the following list was proposed and unanimously adopted:

President, E. Mascart; vice-presidents, for France, MM. Moissan, H. Fontaine and Gabriel; for Germany, Herrn Professors F. Kohlrausch and Dorn; for England, Professor Perry and Sir William Preece; for Austria, Professor Jullig; for Belgium, Professor Eric Gérard; for the United States, Messrs. Carl Hering and A. E. Kennelly; for Hungary, Mr. E. de Fodor; for Italy, Signor Columbo; for Russia, Professor Chatelain; for Switzerland, Colonel Turretini; general secretary, M. Paul Janet; reporting secretary, M. E. Hospitalier.

The presidents of the different sections were then proposed and adopted:

Section 1. Scientific methods and measuring apparatus. M. Violle.

Section 2. Sub-section A; Production and mechanical utilization of electricity, M. H. Hilairet; Sub-section B, Electric lighting, M. Hippolyte Fontaine.

Section 3. Electrochemistry, M. Moissan.

Section 4. Telegraphy and telephony, M. Wunschendorff.

Section 5. Electrophysiology, M. d'Arsonval.

M. Mascart then took the chair and read a telegram from Lord Kelvin expressing the regret he felt at being kept away from Paris by reason of ill-health, and expressing his best wishes to the International Congress of Electricians. It was decided to send a telegram of thanks and of respectful sentiment to Lord Kelvin in the name of the assembly.

The president announced that besides the five sections indicated on the programme, there had been formed a commission of the official delegates of the governments to examine propositions of international interest which will be transmitted to it by the various sections; this arrangement was applied at the Chicago congress.

The meetings of the sections are to be held, commencing Monday, August 20, at the building of the Société d' Encouragement, at Paris; the fourth section, however, will meet at the building of the Société de Horticulture. An extensive programme of excursions and visits has been arranged for. On the 20th of August, Prince Roland Bonaparte is to give a reception to the members of the congress. The members are to make visits to the exposition and to various installations in or near the city.

The papers which are to be read at the different sections of the congress will be distributed in advance, in order to facilitate the discussion. The following is list of the papers to be presented:

Electromagnetic Mechanisms, Professor S. P. Thompson. Quantities and Units, M. Hospitalier. Photometry, M. Violle. Induction Generators and Compounding Alternators, M. Maurice Leblanc. Rectifiers and Rotary Converters, M. P. Janet. The Use of Condensers, M. P. Boucherot. Current Collectors for Railways, M. Postel-Vinay. Electric Lamps, Professor A. Blondel. Electrochemical Deposits, M. Bouilhet. Furnaces Used in Making Calcium Carbide, General Sébert. Wireless Telegraphy, Professor Blondel and Captain Ferrié.

SESSION OF MONDAY, AUGUST 20.

Section 1—*Scientific Methods and Measuring Apparatus.* The session was opened at 9.15 A. M. M. Violle, president, being absent, his place was supplied by M. Cornu, member of the institute. The following vice-presidents were nominated and unanimously elected: Messrs. Arnold, Aryton, de Chatelain, Crova and Kennelly. After reading the list of members inscribed for the session, M. Cornu read the list of communications announced, as follows: M. Arnoux: On Cadmium Standard Cells. M. Blondel: Oscillographs. M. Gino Dompieri: Decimal Time System. M. Hildburg: Dissymetric and Irreciprocal Conduction. M. de Hoor-Tempis: Experiments with Dielectric Bodies. M. Kempf-Hartmann: Measure of Frequence of Alternating Currents. Major John Millis: Photometry of Colored Light. M. Constantin Perskyi: Telephotography. M. de Rey-Pailhade: Upon the Advantages of Adopting New Units Based Upon a Unit of Time Equal to 1-100,000 part of the Mean Solar Day. M. Weyde: On the Mechanism of Electricity. M. Zenger: On the role which is played by galvanic electricity in electrotechnics.

M. Cornu remarked that it would be of great utility to cut as short as possible, the discussion relative to units, which might absorb the whole time of the session. M. Hospitalier proposed the nomination of a committee to study the question of units, and present a report at Friday's meeting. This proposition was adopted and M. Hospitalier was charged with preparing a list of members of this committee.

It was decided to postpone the reading of the papers until the following day. M. Cornu gave some explanations as to the system proposed by M. Rey-Pailhade on the advantages of adopting new units based upon a unit of time equal to 1-1,000,000 part of the mean solar day. The examination of the question was referred to the Committee of Units. M. Hospitalier presented the following list which he had prepared for the Committee of Units: Messrs Ayrton, Great Britain; De Chatelain, Russia; Dorn, Germany; De Fodor, Hungary; Gerard, Belgium; De Hoor Tempis, Hungary; Hospitalier, France; Lombardi, Italy, and Kennelly, United States. The list was unanimously adopted.

M. Cornu asked if any of the members wished to make any communications, M. De Chatelain asked M. Cornu to take the floor. Mr. Cornu said: "As photometry necessarily demands the distinction of the radiations which constitute the light emitted, it is important to define the law of distribution of colors in the spectrum of the light to be considered, because it is upon that distribution which depends the measure of intensity of each color." He took the occasion to protest against the interpretation given in the last few years to the *normal spectrum,* the word *normal* appearing to express a unique and decisive property which is necessary in making a choice of colors classed according to their length of wave. This law does not recommend itself by any special advantage except that it corresponds to the mode of measurement which is the most precise at present for determining the wave lengths (λ). There would be an infinity of arbitrary laws for representing these, which would be more or less advantageous according to circumstances. For instance, the law $\frac{1}{\gamma}$ which represents the relative number of vibrations in a unit of time and the law $\frac{1}{\gamma^2}$ which represents practically the law of dispersion of refracting bodies used in the construction of lenses, etc. It is necessary, then, to choose in each case an appropriate method for the representation of the distribution of radiations.

M. Cornu asked M. Crova to give his opinion upon this subject. M. Crova showed his manner of looking at the subject of representing the radiations. He spoke of a logarithmic scale, which, pro-

ceeding by successive octaves, would, perhaps, permit of best representing the ensemble of radiations from the extreme ultra-violet as far as the electro-magnetic waves. This sequence of wave lengths may again constitute a method of representation more practical than the length of wave. As to comparison of luminous intensities, the greatest difficulty which is encountered is due to the difference of tints. This difficulty may be eliminated as the author of the communication had shown, by reducing the comparison to that of the intensity of radiations corresponding to the same length of wave taken in the two sources. This method, recommended in the Congress of 1899, offered but a few practical difficulties, which it might be possible to remove or diminish. This point could be treated with profit by a committee composed of the electricians and physicists who have given special attention to the subject. M. Cornu thanked M. Crova, and insisted upon the importance of heterochromic photometry. M. Hospitalier recalled that decisions upon the subject had been taken since 1889, but they had not been followed out on account of practical difficulties and that it is in this direction that researches should be made. The meeting was closed at 10 o'clock.

Section II—*a. Production and Mechanical Utilization of Electricity. b. Electric Lighting.*

Sub-section A. *Production and Mechanical Utilization of Electricity.*

The session was opened at 9.15 A. M., by M. Hillairet, president. He proposed to complete the committee by appointing the following vice-presidents:

Germany, Professor Stroecker. England, Professor Silvanus Thompson. United States, Mr. C. O. Mailloux. Switzerland, Colonel Turretini.

These names were unanimously adopted. Communications were presented by Messrs. Bede, of Brussels, Rey, of Paris, and Thury, of Geneva.

Mr. Bede explains a system of contact plow which is on trial at Brussels. The essential organ of the system is a rubber plug traversed by the contact pieces and which serves a three-fold purpose: 1. A movable support for the contact pieces. 2. An insulating stopper for the conduit containing the conductor. 3. Spring for breaking the current when the current carrying piece leaves the contact button. The main conductor of the line is placed in an iron conduit along one of the rails of the track, from which it is separated by a groove of 28 millimetres' width in which passes the plow. At Brussels this conduit is pierced at one metre intervals by holes closed by rubber stoppers. Opposite each stopper the cable is laid bare and provided with projections in copper, insulated, and in contact with the plug. The distance between the contact button and the copper projections is three millimetres in repose. Experiments have shown that the insulation of the whole system keeps up very well. It is found that the running of vehicles has no harmful influence, that the cleaning of the groove offers no difficulty, and there is no accident to be feared to passers or animals. The discussion of the paper was postponed to a later date.

M. Rey, chief engineer of the Sautter-Harle Works, read a paper on the predetermination of the fall of potential in polyphase alternators by means of the theory of two reactions. This theory, due to M. Blondel, permits of determining in a precise manner the fall of tension in polyphase alternators working on inductive or non-inductive circuits. The speaker had occasion to apply this theory to a special alternator of the inductor type, provided with three air-gaps and constructed in the shops of Sautter, Harle & Company. The results of the theoretical calculation coincide in a remarkable manner with the experimental measures made. This machine has the peculiarity that the two reactions, one direct, produced by the wattless current, and the other transverse, produced by the energy current, were of very unequal size. None of the known theories, which suppose the equality of the two reactions could explain the experimental results; the great number of considerations which enter into the theory of two reactions give a special value to the concordance between the calculated and measured figures.

M. Rey then presented to the Congress a note upon the compounding of alternators in the name of M. Blondel, whose illness prevented him from attending the sessions. The system of compounding polyphase alternators proposed by M. Blondel consists in employing a continuous current exciter, whose armature is traversed by the polyphase current of the alternator, or by a derivation obtained by means of a transformer in series. The author shows the conditions which the exciter should fill so that the compounding of the alternator may be effected on an inductive or a non-inductive circuit. He gives the theory of this system of compounding as well as the experimental method deducted from it for the regulation of the divers elements; he recalls the fact that he indicated this method for the first time at the International Congress of Electricians, at Geneva, in 1896; its verification had been made with success at the works of Sautter, Harle & Company on a 100-kilowatt machine with a strong armature reaction.

M. Thury then read a communication upon the applications of boosters to the automatic regulation of the electro-motive force of batteries of accumulators. This regulation presents considerable practical difficulty, especially when the batteries are to operate in derivation, to enable the passage briskly from the charging to the discharging without sensible variation of the tension. The regulation by automatic reducing arrangement is sufficiently precise, but not very prompt, and, besides, this system is costly and complicated, and the regulating parts are difficult to keep in order. Hence the idea to make the regulation by mounting in series with the battery a dynamo whose electro-motive force could vary in the same proportions as that of the battery. M. Thury uses to this end a dynamo whose field can be reversed between two equal limits in passing gradually through zero. In this way the size of the booster may be reduced by one-half. The varying of the field strength is made by an automatic regulator which consists essentially of a motor mechanism of great power. One difficulty comes from sparks at the collector; this is avoided by using machines with short armatures provided with great air-gap and in multiplying the number of poles. The automatic regulation may be facilitated by means of a compound winding; the reversal of polarity is then more rapid. The session was closed at 11.50 A. M.

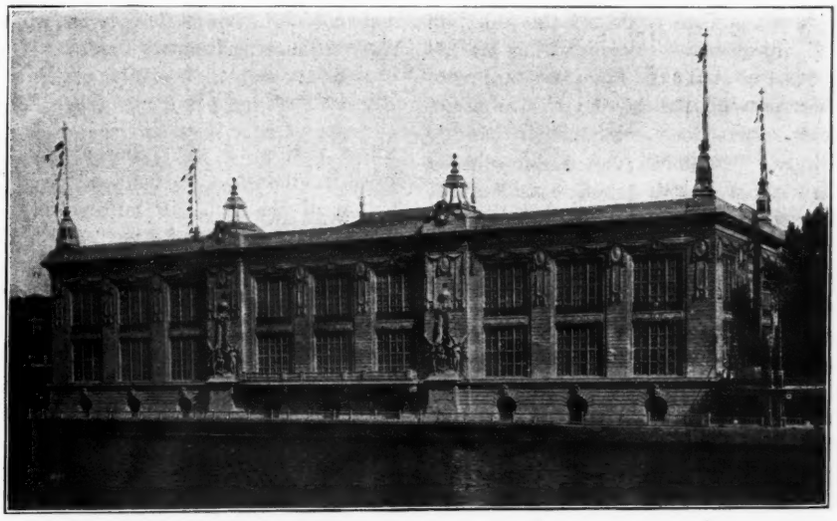
Sub-section B—*Electric Lighting.* The session was opened by M. Hippolyte Fontaine, president, at 9.45 A. M. The vice-presidents elected were: Messrs. Meyer, France, de Fodor, Hungary, and Carl Hering, United States.

M. Laporte read some of the most interesting passages of the paper by M. Blondel on the progress of electric lamps. This paper had been previously distributed to the members. An abstract of Professor Blondel's paper will be published later in the ELECTRICAL REVIEW.

The president then asked for communications upon the subject; he added that it is not quite exact to state that we are returning to arc lamps with clockwork movement; he cites the case of lamps with Gramme motor which have worked very well for 20 years in foundries in spite of the dust and that on account of the powerful motor used.

Mr. Mailloux speaks of clockwork movement for arc lamps in America; they are disappearing, and simplicity is looked for especially. In America high tensions are used. Commencing at 70 volts, 125 volts has been reached. Mr. Mailloux considers that there is no future for high-tension lamps, neither in the way of efficiency, life or luminous intensity. He defends the Hartford installation, which M. Blondel cites as little economic; he says that the efficiency of a lighting plant with continuous current does not exceed 75 per cent, while with alternating current a much better efficiency is obtained. In America the series system is still used considerably for street lighting.

M. de Fodor explained that in America there is not, as in France, the competition with the Welsbach burner; he has himself made tests with the enclosed arc and has found a great instability; he concludes that it is necessary to have a good mechanism in order to obtain a perfect light. At Budapest they have only one type of lamp, which simplifies the maintenance.



THE HALL OF CONGRESSES AT THE PARIS EXPOSITION IN WHICH THE INTERNATIONAL ELECTRICAL CONGRESS WAS HELD.

Mr. Mailloux said that lamps with greatly elongated arcs, from 160 to 180 volts were used, which were branched directly on 230 to 240 volts; but these lamps give a very violet-colored light.

M. Ferdinand Meyer recalls that the voltages have been elevated progressively and that now there is a tendency to pass from 110 to 220 volts; he asks how a company can pass from 110 to 220 volts without inconvenience. M. Fontaine recognizes that the consumer has gained nothing by this change, but he could gain something if the company made him concessions. M. de Foder believed that it would be necessary to reconstruct everything anew. The session was closed at 11.10 A. M.

Section III—*Electrochemistry*. The session was opened at 9.30 A. M. M. Moissan, president, was prevented from being present. His place was supplied by M. Cailletet, member of the institute.

The vice-presidents elected were Messrs. Pagliani and Zenger. The next meeting was fixed for the following day, in which M. Blondin would present a paper entitled Discussion upon the propositions made by Dr. Le Blanc to the electro-chemical section of the recent Congress of Chemistry. The session was closed at 10 o'clock.

Section IV—*Telegraphy and Telephony*. The session was opened by M. Wünschendorff, president. The committee was thus composed: Vice-presidents, Messrs. Roosen (Belgium); Gavey (England); Pinter (Hungary); Strecker, delegate from the German Empire.

The first communication was made by M. André, relative to a telephone system with central battery. The speaker calls the attention of the Congress to the telephone systems of great capacity, whose importance is increasing rapidly on account of the lowering of tariffs, especially in Sweden and America. It is thus indispensable to perfect the processes permitting the establishment of communication between the subscribers, reducing to a minimum the expenses of personnel and material. M. André refers to the efforts which have been made in this direction for ordinary lines as well as for auxiliary and interurban lines. In this system all the sources of energy are centralized at the main station. From the point of view of operation, it is necessary to reduce to a minimum the time which elapses between the call of the subscriber and the response of the operator; this has been arrived at by using as a call signal a small incandescent lamp placed immediately above the corresponding local jack. At the same time that the operator repeats the number, she places the plug in the jack of the subscriber asked for; to assure that he answers to his call, it suffices to add to the calling plug a supervision signal. As to the signal at the end of the conversation, it is given automatically at the moment when the two subscribers hang up their telephone by means of the two supervision signals corresponding to each one. In this way the communication to the operator at the end of the conversation is avoided. M. André mentions the rules laid down for obtaining the maximum efficiency in the case of auxiliary and interurban lines and ends by the comparison of the averages of the number of calls per day and per operator in the old and new systems. These figures bring out a remark by M. Frouin as to the confusion to which the operator would be subjected by such a great number of calls. M. André replies that this objection, well founded in theory, does not hold good in pactice, and Mr. West Bertin, in this connection, remarks that there exists at New York and at Stockholm a system which permits the automatic distribution of calls in order.

The second communication was made by Dr. Rudolf Blochmann, president of the Electrotechnical Union, at Kiel, upon the question of the dirigibility of aerial telegraphic apparatus. He considers what passes in the medium, that is, the terrestrial atmosphere, while the apparatus of wave-telegraphy are in action. Taking for a base the idea that this telegraphy is disturbed during the time of storms, even distant, he thinks that the medium of transmission is the atmospheric electricity. The terrestrial sphere is surrounded by equipotential surfaces, which are not disturbed by an object which is erected in the atmosphere, provided it has not a too-great thickness, a vertical wire, for instance. But if electric fluctuations are produced along the wire, the equilibrium of the equipotential surfaces will be disturbed like the surface of water by a stone. As in the latter case waves will be produced which are propagated, and which may be received by a vertical wire united to the receiving apparatus. In support of this opinion the author brings three arguments, 1, the horizontal reinforcing wire is not suitable for the transmission; 2, it is the same for wires dropping down from the top of a high building; 3, telegrams have been transmitted

at distances where rectilinear propagation seems impossible on account of the curvature of the earth. In terminating the author considers that if the preceding theory is true, the dirigibility of the apparatus now used in aerial telegraphy should be regarded as impossible.

Captain Ferrié asked that the speaker explain why the transmission is better between two stations separated by water than between two inland stations. Dr. Blochmann replied that the equipotential surfaces are much more regularly distributed above the surface of water than over inland territories. The session was then closed.

Section V—*Electro-physiology.* In the absence of M. D'Arsonval, president, M. Bergonié opened the session at 10 o'clock. He observed that as the Congress had been preceded by other congresses, those of Radiology, Radiography and Medicine, the communications of interest were thereby greatly reduced.

Two papers were upon the programme, one by M. Bleyer, upon the sterilization of tissues in tuberculosis, and the use of rays of colored light in these cases, and a second by M. Stanoievitch, upon the analogy between the constitution of the lines of force, magnetic and electromagnetic, and the disposition of cells in plants. The latter of the papers was read; after the discussion which followed, the session was closed at 11.30 A. M.

SESSION OF TUESDAY, AUGUST 21.

Section I—*Scientific Methods and Measuring Apparatus.* The session was opened under the presidence of M. Violle. The first paper was read by Mr. Hildburgh, giving a detailed description of the apparatus proper for the rectification of alternating currents (dissymetric and irreciprocal conduction). The rectification of alternating currents may be obtained by mechanical, physical and chemical processes based on the change of resistance, according to the direction of the current and upon the appearance of electro-motive forces. The dissymetrical conductors may be arranged to send the positive part of the current into one circuit, and the negative in another. The non-mechanical apparatus of this kind presents a high resistance. M. R. Arnoux brought out the advantages, from a practical point of view, of a good standard of electro-motive force for electrical measurements. In 1893, the Chicago Congress proposed the adoption of the Latimer Clark standard cell; but this standard presents some grave defects; first its great variation of electro-motive force, in function of the temperature, which, besides, can not be known with efficient exactness, and again the great variations of internal resistance, which necessitates the use of extremely sensitive galvanometers, which are not very portable. In 1884, M. Czapski called attention to a cadmium element, which only differed from the Clark cell by the substitution of cadmium and sulphate of cadmium for the zinc and its sulphate, showing that the variation of electro-motive force in function of the temperature, is about 30 times less. Later, in 1897, Messrs. Jaeger and Wacshmuth, made at the Reichsanstalt, of Berlin, a very interesting study of the cadmium element, confirming the observations of M. Czapski. M. Gouy, who has made an element of bioxide of mercury, gave to the International Congress of Physics, of this year, a very complete report of the cadmium cell, in which he recognizes that his cell can not rival the cadmium standard as to thermic variation of the electro-motive force. M. Gouy recommends, as do Jaeger, Wachsmuth and Kahle, the H form of cell, but M. Arnoux considers that the ordinary cylindrical disposition is preferable for use in practice, as it permits of realizing cells of a resistance 50 times less, and, in consequence, the use of zero reading galvanometers less sensitive but more portable.

M. Weyde read a paper upon the mechanical applications of electrical phenomena, according to the ideas of Maxwell and the vortex theory. He presents an interesting apparatus designed to reproduce mechanically, the effects of an electro-motive force, continuous or alternating in a circuit possessing resistance, self-induction and capacity. A registering system permits observing the effects obtained when one or other element of the circuit is varied. The session was then closed.

Section II. Sub-section A—*Production and Mechanical Utilization of Electricity.* Mr. Sylvanus P. Thompson read a paper upon electromagnetic mechanisms, a copy of which had been previously distributed to the members. It will be found in full elsewhere in this issue. M. Guéneé, constructor at Paris, stated that he exhibited at the exposition in the electrical section a number of electromagnetic systems in which he has applied the law of Professor Thompson. He has endeavored to reduce the reluctance as much as possible, and has succeeded by using an armature composed of a solid cylinder surmounted by a series of iron washers separated by copper washers of a variable thickness. In this way constant or maximum efforts are produced in a determined point of a course which is relatively long. The most powerful electromagnet constructed after this system produces a constant effort of 600 kilos over 22 centimetres of course. These magnets are applicable to various mechanisms for railroads, signals, switches, etc., and for regulators.

M. Maurice Leblanc read a paper upon the construction of dynamo-electric machines; a copy of the paper had been distributed to the members. M. Ernest Gérard, chief engineer of the Belgian state railroads made a communication upon the resistance of motor-vehicles to traction. To determine the resistance of trains to traction, usage is made of various formulæ found in different countries after careful experiments; they present in general two or three terms, giving the resistance per ton,

$$r = a + bV + \frac{c\,SV^2}{T} \pm m,$$

where a, b, c are the coefficients, V the speed in kilometres per hour, m the inclination of the track in millimetres per metre, S the surface of attack, and T the weight in tons. In the case of trains drawn by locomotives at speeds below 60 kilometers per hour, the term in V^2 may be suppressed, using only the first two terms. Thus the formula of the engineers of the French Eastern Railroad, reduced to the following terms,

$$r = 1.80 + 0.08V,$$

gives a sufficient approximation. It is only above 60 kilometres per hour that it is indispensable to introduce the term in V^2 for air resistance. But it is not the same in the case of isolated vehicles. In this case the air resistance plays an important part at speeds of 30 to 40 kilowatts per hour. The administration of the Belgian state railroads made a series of experiments with electric vehicles, self-propelled, especially to study the motors and controlling apparatus. M. L'Hoest, chief engineer, has collected, among others, data of some precision relative to the resistance of self-propelled vehicles to traction, by measuring with care the power consumed and taking into account the efficiencies of motors tested elsewhere. He arrives at the following formula:

$$f = 1.80 + 0.04V + \frac{0.0415}{T} V^2 \pm m.$$

M. Blondin presented a system of traction by surface contact recently devised by M. Dolter, and which is now on trial over a line 750 metres long at Paris.

In this system the rubbing contact is magnetized by the current of the motors or by a small set of accumulators placed on the car. In passing over a contact-point, this rubbing contact causes the drawing forward of an iron cylinder forming one arm of a bent lever; the other arm puts in contact two pieces of carbon, of which one is connected to the feeder and the other to the contact-point; the latter thus becomes active and the current reaches the motor. This system presents several advantages over existing systems. In this connection, M. Blondin observed that in 1886 Messrs. Pollak and Biswanger had devised a similar system, with this difference, that the current was brought by a double rail with isolated sections and brushes placed under the car, in place of being brought by contact-point to a rubbing-piece; this is, so to speak, the Dolter system reversed. The Pollak and Biswanger system has the advantage over previous systems in that the sections of rail being much shorter than the car, the active sections were entirely below it and accidents were prevented.

The session was then closed.

Sub-section B — *Electric Lighting.* After the reading of the minutes of the previous session, M. Fontaine observed that the constructors who manufacture motor-lamps have never abandoned them by reason of the advantages given to them by the powerful motor used. M. de Fodor observed that at Budapest but one type of lamp is used; the most perfect is chosen and furnished to the consumers. M. Fodor then read a paper, A Proposition of a New Method of Tariff for Electric Current.

M. Lauriol said that a similar system is applied at the municipal plant of the Central Markets (Paris). The consumer pays a fixed sum to which he then adds a portion proportioned to the consumption. The objection which may be made to the system of M. Fodor is that the station is obliged to know what is done by the consumer under penalty of loss by false declarations. Besides, the consumer would have no interest in installing lamps which burned but little. The Wright system may give good results, but M. Lauriol considers that a double-tariff meter, provided with two dials, would be preferable. The Routin system of variable tariff presents some difficulties in application, as the customer believes that he is being charged improperly.

M. Fodor replied that he used a double-tariff meter (an Aron meter with resistance placed in the fine wire circuit). The Wright indicator requires frequent visits, and is not very exact. M. de Fodor said that his tariff varied with the season, this having an interest for double installations (gas and electricity), in which electricity was consumed during the Summer, only if a reduction made its price equal to that of gas. At Budapest the contract system was also used, but only for installation or parts of installations, for which the consumption is well known. M. Fontaine remarked that the observations of M. de Fodor applied more particularly to Austria-Hungary, on account of the considerable development of the Welsbach burner in those countries.

After a short discussion, M. Mornat then read a paper upon "Electricity and Motive Power in Theatres." The discussion of the paper was postponed to a later date.

The session was then closed.

Section III — *Electrochemistry.* M. Zenger replaced M. Moissan, president, who could not be present. M. Blondin criticized the unit designations proposed at the Congress of Applied Chemistry by Dr. Le Blanc, and which he considered as modifying uselessly the designations already admitted. A committee had been appointed to present a report on the subject at the Congress of Physics. M. Hollard, member of this committee, proposed a series of notations which accorded with those adopted by the preceding congresses.

M. Keller read a paper upon Electric Furnaces, which had been previously distributed. In the discussion which followed M. Pitaval asked what would be the best disposition of alternators and furnaces. M. Keller replied that the alternators should be placed about two metres from the furnaces, with a separating wall between the two. In this way conducting systems of 18 to 20 metres in length were obtained, so that the lag factor reached as high as 0.9, while in some installations it was as low as 0.7. M. Keller gave some figures upon the price of electrodes. The expense was 50 to 60 francs' worth of electrodes per ton of carbide, basing upon the price of 60 francs per 100 kilowatts of electrodes. With perfected furnaces, 25 francs of electrodes per ton of carbide was reached.

M. Hollard read a paper upon the principles of electrolytic analysis. In this process, the separation of the metals, based upon the differences of tension of polarization of their salts, has been too much insisted upon. This principle does not hold good in analyses where the polarization tension depends upon the concentration of the metal, and where the concentration diminishes at each instant as the metal is deposited. This principle may, however, be applied where the differences of polarization tension are great enough not to be annulled by the diminution of concentration of the bath; hence follows a first classification of metals in groups. In each group the separation of the metals will be attempted by making them take the form of "complex" ions, and then in one case the deposit can not be made, or, on the other, if the complex ion is partially dissociated, the deposit will ensue, but at a tension of polarization which may be somewhat great in proportion to those of the other metals, so that the separation will be made possible. M. Hollard spoke then of the influence of the current strength and density in analysis, and presented a new system of electrodes. The industrial method of copper analysis of M. Hollard is an application of the preceding principles. The session was then closed.

Section IV—*Telegraphy and Telephony.* A communication from M. Popoff was read by M. Chatelain upon the applications of telephonic receivers in aerial telegraphy. When electric radiations of feeble power are used in aerial telegraphy, it is possible with coherers of every kind (different metals, hard carbon and metal) to obtain a diminution of the resistance during the action of the successive radiations; these variations of resistance are of short duration and may be observed directly by a telephone. Two blocks of carbon and a simple metallic rod permit the reproduction of this interesting phenomenon. In July, 1900, M. Popoff utilized this phenomenon for replacing in aerial telegraphy the receivers with relays by telephones. The receiver includes a battery placed in circuit with a telephone and a coherer with steel granules having several stages of oxidation on their surface. The transmitter is of the Ducretet system.

Experiments made in Winter, in the Gulf of Finland, at 47 kilometres distance, were entirely successful. The masts had 48 metres' height; one of them was at five kilometres from the sea, in a forest. The radiotelephonic receivers were constructed by M. Ducretet.

M. Villot communicated a note upon aerial telegraphy. He points out the origin and antecedents of aerial telegraphy; he thinks that the distance between two stations can not exceed 60 kilometres. The maximum distance is a function of the height of the masts at the two stations. It is indispensable that the two

stations be visible; the rotundity of the earth is an insurmountable obstacle to this form of telegraphy. He presents to the congress some personal ideas on the subject of a new kind of telegraphy utilizing the different strata indicated by the geological charts and permitting the placing in relation of two stations by means of these strata. Experiment alone can indicate the form of transmitters and receivers for this new system.

M. Tissot did not admit the theory of M. Villot and took the side of the theory of equipotential surfaces exposed the preceding day by M. Blochmann. To this effect he mentioned the experiments made between two vessels of the French navy in the English Channel, at 32 nautical miles' distance with masts of 32 metres. In the apparatus used the Ruhmkorff coils were replaced by a small transformer specially constructed for the purpose. As to the coherer, constructed by M. Tissot, all oxidized filings were carefully excluded.

M. Gavey announced that he has been able to exchange a telephonic conversation without wire between a fleet and the main land on the coast of Iceland, the two stations being 12 kilometres distant. He thinks that communications of this kind may render service and be superior to aerial telegraphy at distances not exceeding 12 metres. M. Chage-Pacha stated that in 1886 he made in the harbor of Brest a number of experiments in aerial telephony between two ships 100 metres distant and regrets not to have followed up these experiments. He then made a communication upon the application of submarine microphones to the security of Newfoundland fishermen. These fishermen are exposed to danger from transatlantic liners, and also the small boats which place the lines may stray away from the fishing steamers. The apparatus he proposes consists of a microphone enclosed in a box and plunged in the water, connected to a battery and a telephone on the boat. It is possible thus to hear the noise of a steamer at four or five kilometres' distance. The smaller boat then announces its presence by acoustic or optical signals, to avoid danger. By enveloping the microphone box almost entirely so as to extinguish the sounds (for instance, by a double envelope of lead with lamp black between), and by providing the free part with an acoustic trumpet, it is possible to find out the direction of the sounds. M. Chage-Pacha terminates by asking the congress to make all efforts possible to bring the matter before the chambers of commerce of the different ports.

M. Roosen makes a communication upon underground canalization for telephones. He passes in review the different systems used at present; conduits in wood, iron, agglomerated material, and describes the canalizations of the telephone system of Brussels, in part aerial, and in part underground. After describing the ensemble of the system, M. Roosen explains the system of tile conduits made by H. B. Camp, and gives data as to the placing of the tubes and upon the breaking tests made upon them. He illustrates the system by plates and photographs. After a short discussion the session was closed.

Use of Hot Wire Instruments as Shunt Ammeters.

To the Editor of Electrical Review:

I notice in your issue of August 29 that Mr. W. J. Lloyd takes exception to some of the statements made by me in the paper which I presented before the Franklin Institute, of Philadelphia, last April, which paper appeared in the Electrical Review of July 4 and 11.

Replying to Mr. Lloyd's criticisms, I would say that I endeavored to discuss the principal types of instruments now in commercial use without prejudice, describing as well as I could their relative advantages and disadvantages, together with their limitations. I still believe the hot wire instruments do not meet the requirements of modern shunt ammeters notwithstanding Mr. Lloyd's defense of the system.

For Mr. Lloyd's information I would say that the hot wire instruments which I have tested were not manufactured by the Stanley Electrical Instrument Company, but were made by a foreign corporation; they were, however, identical in construction with those of the Stanley Company as near as possible. Every essential part seems to be the same, the only difference being that the Stanley Company have slightly Americanized some few parts. The manufacturers of the instruments tested by me made the same claims as the Stanley Company, and the figures I submitted were from actual test, namely, a drop of six volts to obtain full scale. I am, however, quite willing to accept Mr. Lloyd's figures as representing the present practice of his company (in fact, I gave them in the article referred to), but would call attention to the fact that a drop of .3 volt is excessive in any shunt ammeter. As you probably know, the D'Arsonval instrument is to-day the standard and accepted type of shunt ammeter for direct-current circuits, and D'Arsonval instruments are constructed every day to operate on a drop of .03 volt or less. This is just one-tenth the energy required in Mr. Lloyd's hot wire instrument. To show this difference in figures, assume a circuit of 5,000 amperes. The hot wire ammeter requires a drop of .3 volt, or a total of 1,500 watts to operate it; the D'Arsonval ammeter requires only .03 volt drops or a total of 150 watts. The difference between the two is 1,350 watts, or 1.8 horse-power at the switchboard. Professor Marks, in a recent article entitled "Commercial Electrical Measurements and Prices," gives the cost of one horse-power per year in a large, well-equipped station as $59.50, which, less his allowance of 15 per cent profit, amounts to $50.49. From this it follows that the excess horse-power required to operate a hot wire shunt ammeter as against a D'Arsonval shunt ammeter costs the station $90 per year for every 5,000 amperes output. This $90 per year represents (at six per cent) a capitalization of $1,500, so it follows that the central station could afford to pay, if necessary (but it is not), $1,500 more for D'Arsonval shunt ammeters to indicate 5,000 amperes than for corresponding ranges of hot wire shunt ammeters.

I did not feel justified in giving so much detail in my original article, but I feel that the figures submitted above justify my statement that "as a shunt ammeter the hot wire instrument is a distinct failure."

Touching on the use of the hot wire shunt ammeter for alternating-current measurements, the power consumption remains the same as in direct-current measurements, and, as the cost of power production is practically the same, the figures given above will apply. As to the variations in indications, when such an instrument is calibrated on direct current and used on alternating current I would say that my personal experience has shown 10 per cent to be a fair average difference. I have not tested 1,000 instruments, but the few I have tested have shown very considerable divergence, particularly on high frequencies in inductive circuits. I am, however, open to conviction on this point when any impartial observer submits actual figures obtained under commercial conditions.

Since it is nearly always possible to measure alternating-current output on the primary side of the line, where the current to be measured is small, I do not see the advantage of a shunt ammeter as compared to a series ammeter which can be calibrated directly at the frequency employed and made absolutely accurate. Where the current exceeds 1,500 amperes a series transformer may be employed.

I presume, since Mr. Lloyd does not combat them, that the balance of my remarks on hot wire instruments, such as heating errors (a matter of considerable moment in shunt ammeters), tendency to burn out on overloads and low resistance of voltmeters, are allowed to pass unchallenged. If I am in error on any of the above points I am ready to be corrected at any time. J. Franklin Stevens.

Philadelphia, September 5.

JOINT MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS AND THE BRITISH INSTITUTION OF ELECTRICAL ENGINEERS AT PARIS.

THE INTERESTING SESSION OF THE TWO FOREMOST ELECTRICAL ENGINEERING SOCIETIES IN THE WORLD AT THE PARIS EXPOSITION.

BY FRANCIS P. MANN.

The combined meeting of the American Institute of Electrical Engineers and the British Institution of Electrical Engineers was held August 16 in the United States Building at the Paris Exposition. In the joint committee in charge of the meeting the American members were: Messrs. Carl Hering, president; Wm. J. Hammer, A. E. Kennelly, C. O. Mailloux and R. W. Pope; the British members were: John Perry, president; W. E. Ayrton, H. H. Cunynghame, R. K. Gray, W. M. Mordey.

MEMBERS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS AND THE BRITISH INSTITUTION OF ELECTRICAL ENGINEERS AT THEIR MEETING IN PARIS.

A large number of American, English, French and foreign electrical engineers were present. The meeting was opened by Mr. Carl Hering, who expressed his pleasure in taking part in this international meeting, which is the first of its kind so far held; he thanked the members heartily for their presence, and hoped that this would be the first of a series of similar meetings to be held in the future, and hoped that the next will be held in America. Mr. Hering then made a short address in French to the foreign members, expressing the pleasure caused by their presence at this meeting, and hoping that at a future time they would be welcomed in America (applause).

Professor Perry, the president of the British Institution, addressed the meeting; he wished to say to the Americans in the name of the Institution, that their visit to England caused the greatest pleasure, more so, indeed, than was expressed by the Americans themselves; he hoped that the cordial relations now existing between the two bodies would never diminish.

M. Mascart, vice-president, then delivered the following address (in French): Gentlemen, I should first address to the Institution of Electrical Engineers of London my lively appreciation of the quite exceptional honor which it has conferred upon me in making me vice-president. I have been extremely touched by that especial mark of esteem, and I will add, of affection, on the part of the members of that society. The opinion has just now been expressed that it would be very useful to make more frequent the meetings analogous to this one, that is, meetings including the members of electrical societies of the most important nations; you have commenced by giving the example, and we thank you for having united at Paris, the members of the two great societies of America and England.

You invite us to go to the United States; I assure you that it would be for me a great pleasure, as I have preserved an agreeable remembrance of the voyage which I made to that country a few years ago, but I begin to be of those who no longer travel much. I hope, nevertheless, that the members of the Society of Electricians, who are already occupied with that question, will respond to your appeal and that soon you will be able to hold in America, in Philadelphia, for instance, a union of the electrical societies of America, England, France and Germany, besides other countries (applause).

But if I can not be with you in that circumstance, I will, nevertheless, accompany you with my most sincere wishes for the success of your gathering.

Now, in the name of the French electricians, in the name of the Société des Electriciens, I thank you heartily for having chosen the city of Paris for your meeting place. I thank, especially our two honorable presidents, who have taken the lead in this quite exceptional meeting (applause).

The subject decided upon for discussion at this meeting was "The relative advantages of the alternate and continuous current for a general supply of electricity, especially with regard to interference with other interests. The discussion was opened by Mr. S. Z. de Ferranti, he was followed by Mr. B. J. Arnold, of Chicago; Sir William Preece, Dr. Kennelly, Mr. Desiré Korda, of Paris; Prof. Crocker, Prof. Ayrton, Mr. Mordey, Dr. David Thompson, Mr. Mailloux and Mr. H. Ward Leonard. This discussion will be printed in full in later issues of the ELECTRICAL REVIEW. After the announcement of the receptions and excursions which were to take place, the meeting was addressed by M. Hospitalier, Major-General Webber and M. Mascart, who pointed out the various points of technical interest at the exposition. The meeting was then closed. A photograph was taken of the group of members outside the United States Building.

A reception was given by the American Institute to the British and foreign electricians at the United States Building on Monday evening, the 20th; a number of excursions were made to the exposition and to various installations in Paris. On Wednesday, August 22, a reception was given by the president and council of the British Institution to the American and foreign electricians in the British Pavilion at the exposition.

Among the Americans present were:

Prof. F. B. Crocker, New York.
C. J. Field, New York.
R. de Foregger, New York.
George A. Hamilton, Elizabeth, N. J.
Carl Hering, Philadelphia.
Wm. R. Hewitt, San Francisco.
H. P. Hill, Charleston, S. C.
J. Murray Hollister, Chicago.
Mr. Holtzer, Brookline, Mass.
G. W. Hubley, Louisville, Ky.
Prof. D. C. Jackson, Madison, Wis.
C. L. Jaeger, New York.
Carl Kinsley, New York.
Frank Land, Syracuse, N. Y.
Jno. W. Lieb, Jr., New York.
Paul M. Lincoln, Niagara Falls.
L. B. Marks, New York.
Mr. Massey, Philadelphia.
E. J. Molera, San Francisco.
Mr. Olmstead, Appleton, Wis.
Mr. Oolgaardt, New York.
Max Osterberg, New York.
Maurice Oudin, Schenectady.
F. J. Pearson, Omaha.
F. C. Perkins, Buffalo.
E. W. Rice, Jr., Schenectady.
A. M. Schœn, Atlanta.
Mr. Skougaard, New York.
Captain G. O. Squier, Washington.
C. P. Steinmetz, Schenectady.
Elihu Thomson, Lynn, Mass.
H. C. Townsend, New York.
J. H. Vail, Philadelphia.
W. W. Weaver, New York.
S. S. Wheeler, New York.
Elmer Willyoung, New York.
Geo. H. Winslow, Pittsburgh.
J. E. Woodbridge, New York.
Mr. Woodward, New York.

INCREASE IN THE USE OF GUTTA-PERCHA IN ELECTRIC CABLE BUILDING.

BY HAWTHORNE HILL.

To gutta-percha has been devoted of late a measure of attention which, perhaps, has not been equalled since this material first became known to commerce, and was seized upon by manufacturers as a possible substitute for india-rubber, the use of which at the time was monopolized under the patents of Goodyear in America and Hancock in England. The test of time proved the new material to be unsuited for the more important uses to which india-rubber has been put, however, and with the expiration of the patents referred to, the use of gutta-percha became confined more and more to that purpose for which it long has been deemed the material *par excellence*—the insulation of submarine telegraph cables. It is on account of a wide-spread demand for more cables that so much attention is directed just now to gutta-percha, and particularly to the question whether existing supplies are equal to current and prospective requirements. The governments of many countries and merchants and the press everywhere are becoming alive to the desirability of additional means for speedy communication across seas.

From the political and military necessity for means of close communication with India, when to Victoria's title of Queen was added that of Empress, grew that degree of interest in ocean telegraphy in England which at once placed that country in a position of undisputed prominence in the cable industry. There was then no German Empire; France had no African possessions comparable in importance with what she now owns; the United States had never heard of the Philippines; and the outside world would as soon have thought of cabling to the Milky Way as to China. But now every first-class power has some such reasons for building cables as led England to establish her first line to India, and the merchants and manufacturers of every land want cable facilities not controlled by foreign powers, just as it is thought to be the thing to conduct the foreign shipping trade of a country under its own flag.

The extent to which submarine cables are being planned is suggested by a list of proposed new lines, compiled by Karl Supf, in the *Deutsche Kolonialzeitung*, of Berlin, aggregating 66,176 nautical miles. The purport of these figures is indicated by comparing them with the total length of the ocean cables in operation at the beginning of 1900, namely, 177,989 miles, this being the result of more than 40 years of active construction. Herr Supf regards as necessary for the construction of the new cables—allowing 80 kilogrammes of gutta-percha per kilometre, or 283.84 pounds per mile—no less than 18,791,254 pounds of the insulating material. It is hardly worth while to follow out Herr Supf's calculations with regard to cost, since prices are variable; the question of real concern is whether so much gutta-percha is obtainable in the near future, or is even in existence. The estimate per mile, by the way, is not excessive. The average weight of gutta-percha used on the 41,853 nautical miles of cable laid in the North Atlantic Ocean from 1856 to 1896, including many short lines, requiring only light insulation, was, according to Dr. Obach, 289 pounds per mile. But for the cable laid by the Anglo-American Telegraph Company, in 1894, the weight of gutta-percha per nautical mile was 400 pounds, and in the Brest-New York cable, laid in 1898, the weight was about 396 pounds. But Herr Supf has overlooked the important detail of the loss of weight in preparing raw gutta-percha for use. Taking Dr. Obach's estimate of loss in wasting—thirty-three and one-third per cent—instead of the requirements stated by the Berlin writer, there would be needed 28,186,881 pounds, or 12,785 metric tons, of commercial gutta-percha. Considering that during the history of the gutta-percha trade (1844-1899) less than eight times this amount of gutta-percha has been produced, and also that a considerable part of the yearly product is not fitted for cable work, it would appear that such large requirements are not likely to be met very soon.

Yet it does not follow that there is reason for alarm. We may wait for convincing evidence that France, for example, is to give effect to the suggestions of the government commission appointed lately to report upon a system of cable communication with the French colonies in Africa and the Far East, for political and commercial reasons. The elaborate plan of the commission calls ultimately for 15,760 nautical miles of cable, at an estimated cost of 130,000,000 francs, though only 9,245 miles are recommended for immediate construction. But the French programme provides for the building of the cables by French works and their laying by French ships, and the existing facilities in that country are inadequate for such an undertaking; besides no credit for cable extension appears in the French budget for 1901, even. Evidently, therefore, the French requirement for gutta-percha is not pressing. Herr Supf has France down for 30,000 kilometres (18,641 miles), or nearly 3,000 miles more than the French commission's estimate.

Some 31,000 kilometres of projected cables are credited to England, (1) for the new cables from the mother country to Cape Colony and thence to Australia, which already have been contracted for, and (2) for the long-talked of Pacific cable, new tenders for which have been invited of late. The gutta-percha needed for the first undertaking is already provided for; it is not impossible that the completion of the system may block the way for some years for the second project. The Eastern Telegraph Company, Limited, and the allied companies regard with no friendly eye the prospective competition of a line across the Pacific, and who can say that their recent alacrity in supplying England with additional cable connections to her colonies, without subsidies, and in reducing cable rates very materially, has not been meant to discourage the Pacific cable project? The investments of the Eastern and allied companies in new cable enterprises during the past fiscal year and in immediate prospect aggregate $18,710,000, including the cost of the lines to Australia *via* South Africa above referred to. The Berlin statistician can mark off his list, therefore, all that he has set down for England except the Pacific cable, and that doubtless will wait until very much more gutta-percha has been brought to market.

With regard to a United States cable across the Pacific, while the prospect is not very definite, it probably is as much so as the new German colonial cable projects which are put down in the Berlin estimate for an equal or greater mileage. The remainder of the estimate is made up of comparatively trivial items.

However emphatic the demands for new cables from so many quarters, probably the actual construction in the near future will not be at a greater rate than for some years past. The total length of submarine cables in operation at the following dates has been, in nautical miles:

At the beginning of 1896...161,578
At the beginning of 1898...167,678
At the beginning of 1900...177,988

At this rate of growth, while the prices of the better grades of gutta-percha have advanced, it has not done so to such an extent as to cause capitalists or cable manufacturers to hesitate to consider any new projects having apparent merit. At present probably 3,000,000 pounds of raw gutta-percha are required annually

for cable purposes, and there is as yet no reason to fear that this rate of production of good gutta-percha can not be maintained.

EXPORTS OF GUTTA FROM SINGAPORE.

	In Pounds.
1889	6,606,720
1890	9,535,680
1891	7,013,440
1892	4,258,240
1893	5,066,880
1894	6,229,467
1895	6,251,200
1896	6,250,000
1897	6,437,733
1898	10,185,333
1899	16,178,133

No one knows how much gutta-percha is still available in the East Indian forests. The years when the consumption in Europe has been large have been marked by heavy exports from Singapore; when the building of cables has been slack, the output of raw material has fallen off, indicating that it has only been necessary for a real demand to exist for the work of collection to be stimulated. During the past three years the exports of gutta-percha from Singapore have been unprecedentedly large, and this fact, rather than any actual scarcity in the markets, has given rise to a fear of the extinction of the gutta-percha species. Unlike the rubber trees of Brazil, which may be tapped from year to year for half a century, the gutta-percha trees are cut only once—when they are cut off at the roots. Hence, unless the supply of trees is enormous, or young trees are maturing as fast as the old ones are destroyed, there may come a time when no more can be found. Already districts once important for their yield of gutta-percha have become exhausted, and the length of time required for new trees to mature discourages the forming of private plantations, while no important governmental attempts at cultivation have been made.

A great problem is what Borneo may have in store. Wherever this immense island has been explored, gutta-percha has been found. Concerning the district of 31,000 square miles controlled by the British North Borneo Company, a recent report says that they "have only touched the fringe of the country, the interior is yet unknown." The same might be said of Sarawak and Brunei, also under British influence, with a combined area of 50,000 square miles. Dutch Borneo has been developed still less. Altogether this island has an area of 183,000,000 acres, mostly covered by forests. Allowing one gutta-percha tree to an acre, with an average yield of eight pounds per tree, the yield would be over 660,000 metric tons of gutta-percha. These are impossible figures, of course, but one might as well fear the early total exhaustion of coal because a single mine has been worked out, as to be alarmed at the destruction of the trees on the mere fringe of a jungle-covered island larger than New England, the Middle States, Maryland and the two Virginias. Besides, there are other islands—Sumatra and Java, particularly—and the Malay States.

But if there should be a falling off in the gutta-percha supply, india-rubber remains as an insulating material from which favorable results have been obtained on not a few short lines of cables. Even if electricians and capitalists should hesitate to adopt this material for long cable spans, it may be pointed out that a very important part of the world's cable system is made up of short lines. Of the cables in operation at the beginning of 1900, there were 1,334 owned by governments, of an average length of only 15.25 nautical miles, and 408 owned by private companies, of an average length of 386.35 miles. Two years ago there were in existence only 38 cable lines over 1,000 miles each in length, and their aggregate, 61,200 miles, formed only 36.63 per cent of all the cables in operation. Much of the cable construction in prospect is to be in short lengths, and in case there should be a gutta-percha famine it is likely that india-rubber would be used for these, leaving the more thoroughly tested dielectric for such lengths as are required for crossing the Pacific This is not written, by the way, in prejudice of the use of india-rubber under any or all circumstances.

The growing demand for golf balls has led to exaggerated accounts of the consumption of gutta-percha in their manufacture. Newspaper accounts have placed this consumption at millions of dollars for the United States alone, but thus far most of the golf balls used in this country have been imported, and the largest imports of gutta-percha goods of all kinds in any one year has been officially reported at $254,332 in value. The value of the raw gutta-percha imported in the same year was only $178,616, making a total of $432,948 for gutta-percha in all forms, for golf and for other uses. Taking the world as a whole, perhaps the increasing manufacture of golf balls has been offset by the declining use of gutta-percha for other purposes, as this material gradually has become more expensive.

The Pacific States Telephone Company made a net gain of 1,550 subscribers in August. The total number connected is 78,852, which includes 19,819 in San Francisco.

Views, News and Interviews

Mr. Sidney Dillon Ripley has succeeded in getting the village trustees in the town of Hempstead, L. I., to repeal an ordinance limiting the speed of automobiles to six miles an hour in the village streets, and four miles an hour when passing horse-drawn vehicles. Mr. Ripley requested the Board to repeal the old ordinance, and pass a new one allowing a speed of 12 miles an hour. A compromise was effected by making the speed limit 10 miles an hour.

Fifty years ago, on August 28, 1850, the first submarine cable message was sent from Cape Grisnez in France to Dover. A wire insulated by a gutta-percha covering was run across the channel from the Admiralty Pier at Dover to prove that messages could be sent, and the following year the first strong cable was laid. Mr. Charles Wollaston, one of the party that laid the first wire is still alive and says that the first message sent under the sea was to his wife and said, "All right at Grisnez, home about ten."

A prominent carbon manufacturer said the other day in conversation that he had just received a shock from which he would not recover easily. "We received a telegram, a few days ago," said he, "from a man that we supposed to be a leading electrician in an eastern town, wanting to know the formula for painting electric light carbons. He had bought some plain carbons and wished to paint them a copper color, and he thought he could probably do it cheaper himself than to return the carbons to the factory to have them painted. How's that for intelligence?"

It is hard for us, in America, to understand the curious mixture of ecclesiastical red tape and conservatism which has practically prohibited the electric light from use in many churches in England. In this connection the following extract from a sermon on "Burden Bearing," preached by the Rev. W. Muzzel, the rector of St. Paul's, Withington, will be of interest: "Nature was often made to share our burdens, and I wish the people of this church would assist Nature by illuminating the place with the electric light, so that their lives might be spared for a few years, as God intended them to be spared, instead of running the risk of being poisoned by having to breathe (especially in the close, warm weather) the vitiated and poisonous atmosphere caused by bad gas."

THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES; ITS FIELD AND WORK—PAST, PRESENT AND FUTURE.*

BY JOHN W. LIEB, JR.

I wish to apologize for not presenting the address of the president in a more formal manner; but, having been indisposed for some days, the time selected for its preparation was not available.

Of various subjects that might be of interest I finally concluded that the one which, at this time, would perhaps best appeal to you is: "The Association of Edison Illuminating Companies; Its Field and Work—Past, Present and Future." My reason for selecting this subject is that there are many new members with us, as well as other members who have not attended any sessions of the executive committee, who are not familiar with the work that the association is doing, or with the conditions embracing some of the peculiarities of its organization and management, and I thought it would be helpful to us in laying out our work if the new members could become acquainted with the field covered by the association in its work.

The object of this association, as defined in the constitution and by-laws, is: "The mutual protection of business interests and the collection and dissemination among its members of technical and business information relative to the Edison electric light system and auxiliary systems operated in connection therewith." You will thus see at the start, from this statement of the object of the association, that there is a striking difference between our organization and kindred organizations such as the American Institute of Electrical Engineers, the National Electric Light Association and many of the state organizations. Instead of being a purely technical body, like the American Institute of Electrical Engineers, this association, while, in one sense of the word, technical, has, in addition, important commercial interests to safeguard. One of the conditions of membership requires that its members be licensees under the Edison patent; that is, licensees of the Edison Electric Light Company, the Edison General Electric Company or the General Electric Company.

There is one striking peculiarity in our organization, and that is that companies, and not individuals, constitute the membership of the association. The officers are merely the representatives of the companies constituting the association. This fact, which is peculiar to our organization, has advantages and possibly some disadvantages. It is, of course, to be expected that in a body of this character, in which manifold interests are represented and which has such a wide field of activity, the larger companies take a predominant interest. This must be the case from the connection of many of its representatives with the original Edison interests; it must also be so from the fact that the larger companies have large executive and operating staffs and therefore are more largely represented in the conventions, and, as authors of the papers that are brought before it. I think you will agree with me, however, that in the work of the association, due weight has been given to the value of the membership of the smaller companies, and that every effort has been made to stimulate their interest and attendance, and I am happy to say that in this respect we have been markedly successful. The smaller companies, by their attendance and active interest in the work of the association, have, in turn stimulated the larger companies in their work in its behalf.

The main work of the association is done by its standing committees. In addition to the executive committee we have a lamp committee, one of its sub-committees, and, as standing committees of the association: A meter committee, a committee on grounding of the neutral, an automobile committee and a committee on Welsbach light and acetylene gas. As indicative of the work which the association does, and its peculiar nature and scope, I will refer briefly to the work that the lamp committee has had in hand. This feature was started originally by four of the larger companies who were buying incandescent lamps in great quantities and who felt that it was time to institute some new method or basis of purchase, safeguarding themselves as to quality of the product by framing an agreement incorporating a set of specifications. In order to insure compliance with the specifications a lamp testing bureau was organized, and these companies advanced a guarantee fund with which to conduct the business of testing lamps. The mutual relations of the General Electric Company and our member companies made it possible to prepare a tentative agreement covering the desired features, and it is impossible to see how, except through the relations which existed between the parent company and its licensees (members of this association), such an agreement could have been made. It was purely experimental in its nature, and, of necessity, there must have been a great deal of "give and take" until a mutually satisfactory basis was framed. As a result, we made a lamp agreement which was sufficiently liberal and elastic in its terms to make it acceptable, and a clause was embodied in the agreement that in case the specifications agreed upon and which defined the quality of the lamps in terms of a new unit were shown to work a hardship to either party, the specifications were to be amended at once by mutual agreement.

The lamp committee's work for the past year will be referred to in detail in a subsequent report.

The meter committee has also been actively at work, and we hope that the outcome of its efforts will be of as much value to the association as the work of the lamp committee, and that the purchase of meters designed to best satisfy the requirements of our members will be facilitated by the making of an agreement containing specifications which shall be the basis of a standard product to be furnished to our members at the lowest price consistent with good workmanship and a reasonable profit to the manufacturer.

The automobile committee has in hand the work of recommending to the companies standard charging posts and plugs in connection with the charging of automobiles to facilitate the delivery of current to automobiles as they journey from city to city. Permit me to suggest at this time that our field of usefulness could be developed advantageously by adding to these standing committees a committee which would undertake the standardizing of switches and other electrical appliances. All of our members are purchasers in large quantities of switches of various kinds for station switchboards, service work and interior installations, and it is certainly undesirable that each company should have a standard of its own, as the conditions to be met are practically the same. In different cities, the requirements of the fire underwriters and local authorities are usually the same, and if standard specifications could be agreed upon to enable all manufacturers to bring out standard types which could be produced in large quantities, the result would be a cheapening in the cost of production and a reduction of cost to the user.

Another subject of considerable importance we have not specifically taken up is municipal ownership and I think it would be wise at this time to have a standing committee on that subject. Such a committee could keep in touch with the agitation that is occupying the attention of some cities advocating municipal ownership as well as supervision and control of gas and electric works, traction enterprises, etc. Many of the smaller companies have the greatest difficulty in battling against these attempts to legislate them out of existence, and I believe that a committee of this association that would collect, tabulate and distribute information on this subject of an accurate and up-to-date character would be of distinct value and assistance to members requiring ammunition for their defense.

In the early days of the electric lighting industry the standardizing committee of the Edison interests did valuable work in the standardizing of Edison chemical meters and many Edison appliances; one of your former presidents, Dr. A. E. Kennelly, rendering valuable service in this field. Much of this early work has been of value not only to the Edison interests, but has become part of the history of the art. Many of Dr. Kennelly's investigations and experiments conducted in connection with this standardizing work have become the accepted reference data in electrical engineering work. I need only refer to his tests on the carrying capacity of wires under different conditions of cross-section, insulation and environment. This association, through its member companies and their technical staffs, has done valuable work for the industry generally; through their close relations they have been able to find useful applications for newly developed apparatus, and, once found, these types have had prompt and general adoption to the material benefit of themselves and the general advantage of the electrical industry. I refer in this connection to the stimulus given to the application of storage batteries to central station service by the pioneer work of some of the larger companies, by the interchange of experience in their use inducing others to determine each for itself the advantages which it might derive from their use. There can be no doubt that the work of the companies constituting your membership and the reports of your committees have materially contributed toward the development and improvement of what is now considered an invaluable adjunct to central station and distributing equipment. I will also refer, briefly, in passing, to the influence which the members of the association have had in stimulating the manufacturers to produce new apparatus to meet new requirements as they arose; and to the influence of the individual companies in stimulating the development of such apparatus as the first examples of direct-connected units, arc lamps on low-tension circuits, rectifiers, phase and frequency changes, composite generators, etc. The members of this association have exerted a constant pressure upon the manufacturing companies in bringing them to realize that they must develop apparatus to satisfy new conditions and requirements, as the extension of their business developed new wants. It is unquestionably true that the manufacturing companies have in turn profited by the development of this apparatus in being able to find at once purchasers and an outlet for their products among our companies, whose close connections enabled them to promptly appreciate the value of newly-developed apparatus.

During the existence of the association, the member companies have gradually broadened their business field. Originally confined to companies that were Edison licensees, exploiting exclusively the Edison system, most of the companies now find themselves in new relations with their former powerful and conservative competitor, the gas interests, new relations in connection with the development of transmission lines in conjunction with their distributing systems, and new relations in connection with

*Presidential address before the Saratoga Springs convention of the Association of Edison Illuminating Companies, September, 1900.

alternating-current generation and distribution, and new relations in connection with the joint operation or absorption of series arc systems. These new relations must necessarily bring us into contact with new problems, with points of view broader than simply the Edisonian, and it is hardly necessary to say that contact with these new interests and the assumption of these new relations must be of great benefit to us. Take for instance the gas interests. For years they have been developing their business and organization, and their knowledge of the public and its requirements must be vastly superior to the knowledge possessed by those engaged in our more recently developed electrical industries. Their methods and policy have been developed on conservative lines, their usually strong financial position attests executive ability of the highest order, and we certainly must profit by closer relations with this older well-established industry. They, in turn must profit by feeling the youthful pulse of the new industry which, in spite of opposition and keenest competition, in spite of large vested interests arrayed against it, has been able to assert itself and claim a permanent position as one of the safest as well as most remunerative fields of investment. It seems to me, therefore, that these new relations, which are daily increasing, must be mutually profitable. It is also true that the new relations with transmission systems, the various forms of distributing systems, joint operation in combination with railway systems, will enable electric companies to broaden their field of operation, and these features will all be helpful to it in enabling the supply company to generate its product at reduced cost. I know of no body of men which could so successfully handle these new demands, assimilate, cooperate with or become an adjunct to new interests and broaden the field of industrial enterprise as the men constituting the administrative and technical staffs of the companies that are members of this association. The readiness with which the Edison companies have assimilated the new systems, the fertility of resources they have exhibited in combining with other systems, retaining what was best, discarding the less satisfactory features, often modifying or even entirely changing the strictly Edisonian point of view, where contact with other systems and other apparatus showed this to be of advantage in meeting the new situation. These qualities of the organization, system and equipment which the Edison companies displayed, is sufficient refutation of the statement one hears now and then, that the Edison companies are narrow viewed, ultra-conservative and non-progressive, adhering to antiquated tradition and slow to rise to the new responsibilities.

We claim that this association can with pride assert itself to have been the pioneer in developing broad lines, and the uniform success of the Edison companies which are members of this association, amply demonstrate the excellence of the lighting and power system with which we began our development, and the faithful energy with which the business has been pusned.

I would refer to the fact that the association has enjoyed the sympathy and goodwill of the press, notwithstanding the fact that we have supplied it with only brief reports of our conventions, our business proceedings, many of the papers presented and the discussion thereon being, in great measure, of a confidential character. The good work we are doing, and its advantage to the industry at large, have, however, secured us the sympathy of the press—a substantial aid in the prosecution of any undertaking, in the benefits of which the public has a share.

While the few remarks I have made are hardly such an address as you may have expected, or as I should have desired to present, I hope they will be helpful to you in obtaining a just and adequate idea of the work which the association is doing and what it may be called upon to undertake, and they may stimulate the mutual cooperation of our members and the interchange of information to our mutual benefit.

Science Brevities

Magnetic Intensity Variometers—The magnetism of a bar and the directive force of a bifilar suspension are not free from changes in the course of time, and are greatly affected by temperature. Herr M. Eschenhagen has therefore adopted quartz fibers in order to obtain a simple torsional suspension. The systems of magnets and suspensions usually employed with magnetometers weigh at least 20 grammes to 30 grammes, and are therefore not suited for quartz fibers, as the latter would have to be too thick for the proper sensitiveness. The author has therefore provided a light system of magnets weighing about 1.5 grammes, and has found them to possess several distinct advantages, such as easy accessibility, adjustable damping, and a fixed mirror for photographic registration, which can be displaced with ease and certainty, says an *Electrician* abstract. For intensity variometers a quartz fiber, not too thin, about $\frac{1}{10}$ mm. to $\frac{1}{20}$ mm. thick, is selected, and the upper end is twisted until the magnet lies perpendicularly to the magnetic meridian. The author employs a simple expedient for increasing the sensitiveness of an instrument. He uses a fixed directive magnet parallel to the needle and below it. If the poles of the directive magnet are placed opposite the like poles of the needle the instrument becomes more sensitive, if in the contrary position it becomes less sensitive.

Dielectric Strain—The expansion of a dielectric in an electrostatic field has been adduced as an experimental proof of the theories of Faraday and Maxwell, but the results described are anything but concordant. Röntgen ascribes the observed changes of volume to the electric compression of the electrodes and the heating effect of the free charges on the surface of the glass or liquid. Mr. L. T. More has endeavored to meet this criticism by a special arrangement of three concentric tubes, the inner one being brass, enclosed in a glass tube surrounded by another brass tube. The results of his experiments, however, lead him to the conclusion that the stress occurring in the ether when a dielectric is electrostatically charged causes a mechanical deformation of the substance says one of Mr. Fournier d' Albe's abstracts. At least, if there is such an action it must be extremely minute—perhaps a slight rearrangement of the molecular structure—as an effect so large as one expressed by the formula $KH^2/8\pi$ would be very appreciable. Though it might have been expected that such ethereal stresses would change the length of a dielectric both along and at right angles to the lines of induction, yet as one of these is a tension and the other a compression of equal amount, it is difficult to see how any change of volume other than a differential effect would result; whereas Quincke finds that the change of volume is nearly three times as large as the linear expansion. A strain as indicated is not met with in any allied field of investigation.

The Conductivities of Oxides—In a contribution to the *Elektrotechnische Zeitschrift* Herr J. Sohlman gives the results of some experiments which he has conducted in order to determine the relative conductivities of various oxides and oxide combinations when heated. The experiments showed that the conductivities of different oxides, and especially the temperature at which they commenced to be appreciably conductive, varied very considerably. Such oxides only as Mr. Sohlman deemed of possible utility for lamp filaments of the Nernst type were experimented with. The oxides of beryllium, magnesium, and calcium proved to be very bad conductors even at high temperatures, requiring especially high temperatures in order to render them appreciably conductive. On the other hand, oxide of zinc showed better conductivity, its conductive stage being more readily attainable. Comparing the chemical properties of the oxides experimented with, it was found that with one exception those of relative bad conductivity possessed strong bases, while those of good conductivity were characterized by a more or less pronounced acidulous formation. The results obtained have led Mr. Sohlman to conclude that the conductivity of an oxide is a periodical function of the atomic weight of the particular element concerned, as is the case with many other physical properties of the elements and their combinations. The conductivities of the chemical combinations between oxides of different bases (salts) show a dependence upon the chemical properties of the constituent elements, though the ultimate conductivity generally varies very greatly from the conductivities of the component elements. It may also be observed that oxides which differ only very slightly in their bases may yield combinations which possess conductivities differing very considerably from those of the separate components. For instance, oxide of thorium in combination with oxide of lanthanum, which has only a slightly stronger base, yields a substance which is a good conductor, while each of the oxides mentioned taken separately is a bad conductor.

A SPANISH SURVIVAL.

SOME INTERESTING NEWS ABOUT THE ELECTRIC LIGHTING SITUATION IN SAN JUAN, PUERTO RICO.

In common with other good Americans, the ELECTRICAL REVIEW has watched with much interest the growth of Puerto Rico in fact into what it is in name—a part of the United States. The island is beautiful, exceptionally fertile, with a delightful climate, and is inhabited by a law-abiding people who will make good citizens of their adopted country when they become better acquainted with their continental fellow citizens and learn that the latter have a strong desire that Puerto Rico shall develop and prosper. National pride prompts this desire, as we must make this first attempt at colonization successful in the eyes of the Old World. Aside from this, American capital and American families already form a substantial part of Puerto Rico's resources, and we look forward to much greater progress in this direction when the possibilities of the island are understood, both in the way of agriculture and commerce, and, besides, as a Winter resort of the most delightful kind.

One of the marks of progress is the substitution of electricity for gas in lighting the capital, San Juan. This is a beautifully located city of about 35,000 people, with a fine harbor and substantially built houses of stone and concrete-paved streets, a good water supply and other evidences of urban progressiveness. A trolley road, built by American capital, is under construction, and will, in a few weeks, furnish modern rapid transit facilities.

In the midst of so much that is up-to-date and good, the citizens of San Juan are unfortunately being misled about electric lighting, and our Puerto Rican friends are making some unfortunate mistakes.

The specifications for the city lighting call for about 100 arc lamps and about 150 incandescent lamps, and the contract period is five years. There are two companies competing for the business—the old Spanish Company, equipped with the Edison three-wire system, and the tramway company, which is erecting a 2,200-volt alternating-current system. The city official who drew the specifications evidently had something in mind when he drew them other than the strict necessity for the protection of the municipality. Observe the ingenuity of the following clauses, viewed either as a handicap to the tramway company in bidding, or as a club to discipline it should the unkind fates decree the letting of the contract; thus:

"The contractors shall furnish the number of lights necessary to light up the section contracted for, although the required increase of the number of lights is not stipulated in this contract."

"The hour for beginning to furnish light shall be determined by the municipal council or by the officer in charge of this service."

The last was too obvious, and a supplement to the specifications was issued specifying the hours of lighting (from sunset to sunrise).

"As a guarantee of good faith in the carrying out of this contract, a lien shall be laid on all material and the plant, and neither the material nor the plant shall be altered in any way without demonstrating the advantages of the alteration and without the consent of council."

"If the contractor fails to furnish lights for any reason whatsoever, the following penalties shall be imposed upon the contractor:

"1. In case a lamp is thrown out of service and should fail to furnish light during 30 minutes without being fixed or substituted by another, the contractor shall be fined $1 for every 60 minutes that the lamp remains out of service.

"2. In case all the lamps from one circuit should fail to furnish light during 30 minutes, the contractor will incur a fine to be imposed as calculated above, according to the time that the lamps have been out of service, plus 20 per cent of this amount. The same rule shall be observed in case all the lights in any one section should go out of service.

"3. If the lack of the illuminating power is over 50 per cent, or if faults in lighting should be repeated and the fines should amount to 10 per cent of the total cost of lighting the city during one month, the municipal council shall have the right to annul the contract."

"The contractor shall keep on hand, as a reserve, one-fourth of the total number of apparatus required for furnishing lights to each section: four dynamos, four boilers, two engines, two chimneys, and a sufficient quantity of wire for repairing the line."

(The old Spanish company has just this amount of apparatus: the tramway company has less.)

The tramway company put in a bid on its own specifications, and the Spanish company bid on the advertised specifications, but on account of some irregularity in the advertising both bids were thrown out and a readvertisement ordered.

The new specifications permit the Mayor to reduce the hours of lighting at will, and specify explicitly that the lighting shall be done by the continuous-current, low-tension, Edison three-wire system. A happy disregard for constitutional provisions is shown by the clause stating that the municipal council shall decide as to the validity or invalidity of the letting, without appeal from its decision.

Such proceedings as the above are hardly calculated to raise the Puerto Ricans in the estimation of the outside world, and conscientious Puerto Rican citizens should oppose such evidences of unfairness and bias on the part of their city officials. Perhaps Governor Allen will feel constrained to take a hand in such proceedings.

Another phase of the matter appears in the newspaper attack on any system but the low-tension. The San Juan *News* publishes a telegram, alleged to have been received from New York, as follows:

NEW YORK, August 21.

News, Puerto Rico.

Managing Editor Harrison, of the *Electrical Age*, and Managing Editor Hedenberg, of *Electricity*, the most prominent experts in the world, declared that the installation of the alternating-current, high-tension system of lighting in San Juan would be little less than a crime. Mr. Harrison pointed out that the high-tension system would at first be cheaper but eventually much dearer, the low-tension system being better in every way. The high-tension system is most dangerous where wires are strung on housetops, and is almost criminal. Especially would this be the case in San Juan, where people unacquainted with the dangers are constantly on the roofs.

The first week of the alternating-current, high-tension system would mean death to many.

The shock resulting from contact with the wires of the direct-current, low-voltage system does not kill and fire is the only danger to be feared.

Mr. Hedenberg was equally emphatic regarding the dangers from wires of the alternating-current, high-tension system.

Such wires, he said, must be placed underground in San Juan, otherwise they would work havoc to life and property.

(Signed) "SUN."

It seems probable that the "most prominent experts in the world" were misrepresented or that they forgot something. It is hardly necessary to point out the fact that the statement contained in the above quotation is ridiculously false. A large proportion—probably more than three-fourths—of the towns in the United States of the size of San Juan are equipped with alternating-current distribution at anywhere from 1,000 to 5,000 or 6,000 volts, and practically all of them have direct-current series arc systems running up to several thousand volts. There is practically no danger in a properly installed alternating system of 2,200 volts, certainly no more than in a slackly installed

110-volt, three-wire system. There is nowhere nearly as much danger in either as there is in a gas piping system as ordinarily put in a dwelling house. Possibly the "most prominent experts in the world" forgot that 6,600 volts, alternating, is a common voltage in New York city, practically all its lighting being fed from such circuits. It is deeply to be regretted that the name of the New York *Sun*, a newspaper whose status should preclude any possibility of its correspondence service sending out interviews with unknown and irresponsible people, should be signed to the despatch quoted above. Is it possible that the business methods of the ancient Spanish régime still obtain in Puerto Rico, and that they are extending to the Americans doing business and publishing newspapers there?

New York State Street Railway Association.

The eighteenth annual meeting of the Street Railway Association of the State of New York, will be held on Tuesday and Wednesday, September 18 and 19, at Buffalo. The headquarters will be at the Hotel Iroquois. The entertainment programme includes several trolley rides of great interest in the vicinity of Niagara Falls, and a searchlight excursion to the Whirlpool Rapids.

The programme for Tuesday provides for a meeting of the executive committee, at 9.30 A. M., and a general meeting of the association at 10.30 A. M. The annual dinner will be held at 8 o'clock in the evening at the Iroquois Hotel. On Wednesday, at 9.30 A. M., the second session of the convention will meet. Unfinished business will be disposed of and papers will be read and discussed. The topics for discussion are of the most practical character, and the meeting promises to be a very interesting one.

Great expectations are entertained and many plans are being formed in Puerto Rico for the installation of short inland electric railways from the central range to the coast. The power is to be developed through the agency of many streams to be met with in every part of the mountain range which traverses the island from end to end. If all that is expected in the way of new roads and other electrical works is accomplished, there will be a field in Puerto Rico for considerable electrical machinery and material. The only road on the island, from the capital to Rio Padres, some nine miles in length, is shortly to be equipped electrically.

Electric Railways

Coshocton County, Ohio, has granted a franchise for an electric road between Coshocton and Newcomerstown.

The projectors of the electric railway which it is proposed to run between Cazenovia, N. Y., and Syracuse are busily at work securing the right-of-way for the road and indications clearly show that the work of constructing the road will be begun soon.

The Northern Ohio Electric Company, which is to build a trolley line from Wheeling to Wellsburg, W. Va., has organized permanently. Howard Hazlett was elected president, John G. Welty, vice-president, and John Arbenz, secretary and treasurer.

The selectmen of Palmer, Mass., at a recent meeting granted the franchise asked by the Palmer & Monson Street Railway to extend its tracks to the Wilbraham line. The conditions of the franchise are similar to those already granted the company in Palmer.

President George E. Fisher, of the Pontiac-Orion, Mich., electric line, states that the grading of the road will be completed this Fall and that the ties and rails will be laid early in the Spring. Engineers and surveyors are now going over the route preparatory to grading.

Everything is now in readiness for work to begin on the electric railway at Greenville, S. C. Fourteen car-loads of steel rails have arrived. It is thought that work will begin during the coming week. There is steel rail enough to lay eight miles. Several open cars are in the car barn.

The El Paso, Tex., and Juarez Traction Company received recently from the Mexican Government a concession for the construction and operation of electric street car lines in Juarez. The company holds a franchise for an electric street railway system in El Paso, and will begin its construction to connect the two cities and traverse their streets.

The Greenwich & Schuylerville, N. Y., Electric Railway Company has filed notice with the Secretary of State of a proposed change in route in its extension to Fort Edward. Instead of making the extension in the town of Saratoga it will commence at Thompson's, in the town of Greenwich, and extend over private lands and public highways to Broadway, in Fort Edward, where connections will be made with the Glens Falls, Sandy Hill & Fort Edward Railroad.

The United Gas Improvement Company, of Philadelphia and New York, it is understood, will apply next year for a charter to construct an extension to the trolley lines that now end at Woodmont, Ct., over the country road a mile north of the present Woodmont line to Savin Rock, thence to New Haven *via* either Davenport avenue or Washington street. The proposed road would enter Savin Rock over the southern Milford turnpike and by a spur connect with the Rock proper north of the ball grounds, the main line continuing out West street to Washington avenue, thence to New Haven.

Although much time has elapsed since the granting of a franchise by the village to the Syracuse, N. Y., & Oneida Lake Railroad Company, little seems to have been done in the way of beginning the road. The citizens believe, however, that the road will be completed and in operation before the expiration of the time limit, which will expire on July 1, 1901. A movement is now under way, which is understood to be backed by Supervisor Frank L. Smith, to request the Syracuse & Oneida Lake Railroad Company to secure the right-of-way from Phœnix to Pennellville and thence to Roosevelt for the purpose of extending the proposed line to the latter place. It is said that the farmers along the line are favorably inclined to the project and that their consent can be readily obtained.

The annual report of the Metropolitan Street Railway Company, of New York city, was filed this week with the state board of railroad commissioners. It shows that the miles of road operated during the past year have been 217, that the gross earnings were $14,721,550, that the operating expense was $7,104,607, and that the percentage of operating expense to gross earnings was 48.26 as compared with 48.70, a decrease of .44 per cent. The net earnings for the year were $7,616,943 and the fixed charges were $4,608,768, leaving a balance of $3,008,175. The total gain for the year in the receipts of the road was $3,360,160, from which dividends were paid amounting to $3,145,891, leaving a surplus of $214,269. The report and the comparisons both are exclusive of the Third Avenue line, which was lately acquired by the Metropolitan and which comprises 209 miles in actual service and between 35 and 40 miles of undeveloped franchises to the north of New York city.

Export Notes

The Morgan Engineering Company has just booked an order for two good-sized electric overhead traveling cranes, to be used in a machine shop at Havana, Cuba.

The Costa Rica Electric Light and Traction Company, of San Jose de Costa Rica, has been granted permission by the city authorities to extend its electric roads in the city and to Sabana, etc. Messrs. Andreas & Company, of New York, are the purchasing agents in this country for the above company.

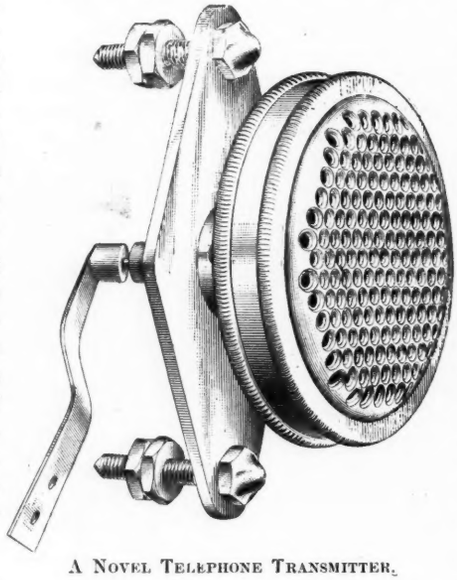
Messrs. Ceretti & Taufini, of Milan, Italy, who are said to be prominent contractors and engineers there, are asking for quotations in this market direct from manufacturing firms for wire rope, electric tramway supplies and contractors' equipment of various kinds. This firm has various large undertakings underway not only in Italy, but also in Spain.

The Emerson Electric Manufacturing Company, of St. Louis, Mo., is about to make a shipment to Buenos Aires, Argentine, consisting of some 400 Emerson alternating-current ceiling fans. This shipment makes up nearly a car load of fans. The order was secured in competition with American and European manufacturers. The same company recently shipped to Budapest, Hungary, a quantity of such electric fans.

Die Deutsche Wachwitzmetall Gesellschaft is the title of a company which has lately been formed, at Nuremberg, Germany, with a capital of $500,000, to acquire and exploit the rights in a new iron-aluminum and copper-aluminum alloy. Land has been acquired by the new company at Hersbruck, near Nuremberg, on which to establish works for the manufacture of the new alloys. Considerable machinery and many improved tools will be required by the new company.

Mr. John Marsden Ward, an agent of the Shah of Persia, who has been in New York examining trolley lines, states that the Shah will build the longest line in Asia. It will be some 93 miles, between Teheran and a port on the Caspian Sea. Mr. Ward is to go to Philadelphia to visit the shops of the Baldwin Locomotive Works with a view to making a report upon engines for use on the new railroad between Teheran and the Persian Gulf. Possibly a second railway line may be built to the Gulf with all possible speed. The roads will be built largely with Russian capital and under the supervision of Russian engineers, but Mr. Ward, it is stated, will be the authority upon the machinery, rolling stock, etc.

The annual meeting of the Buenos Aires Grand National Tramways Company, Limited, was held in London on July 16, 1900. From the report of this corporation, for the year ending March 31, 1900, the following facts are obtained: The number of passengers carried was 15,800,000, against 13,298,000 in 1898-99; the number of miles traveled was 4,269,000, against 3,600,000 in the previous 12 months. The gross receipts per mile were 7.64d., against 7.39d.; the expenses were 5.87d., as against 6.04d.; the net receipts per mile run were 1.77d., against 135d.; traffic receipts aggregated £138,279, against £110,271, and the net revenue in Buenos Ayres was £32,018 as compared with £20,627 in the preceding year. After paying the London office expenses, there remained a net balance of £6,282.



A Novel Telephone Transmitter.

The electric lighting companies of the city of Buenos Aires have entered a joint protest against the new tax imposed upon them by the municipality, which, they claim, is a duplicate of another tax. These various taxes imposed, it is claimed, check the advancement of new work of similar kind. An instance of what business the telephone company transacts in the Argentine capital may be inferred by the report just issued by the directors of the Sociedad Co-operativa Telefonica for the year ending June 30 last. The profits on the year's working shows a credit balance of $113,240.69. The company possesses a large installation of underground mains. L. M. Erricsson & Company, of Stockholm, Sweden, are building multiple boards for the new central office at Buenos Aires, at a cost of $25,000, gold.

Electric Lights and Fans for Passenger Cars.

The Consolidated Railway Electric Lighting and Equipment Company, 100 Broadway, New York, illustrates elsewhere in this issue of the ELECTRICAL REVIEW the mechanism of its electric equipment for lighting and ventilating all kinds of passenger coaches. The necessary current is generated from the car axle while the car is in motion and supplied automatically from a storage battery when the car is stationary. Each car carries its own electric lighting and ventilating apparatus, being entirely independent of all other cars and of any distant stationary plant. The electric lights and fans keep a car bright and cool and avoid all discomfort from heat, smoke and glare and all danger from fire or explosions where gas or oil lamps are used. The axle light equipment is automatic and self-regulating in its operation, and, therefore, its cost of maintenance is insignificant when compared with the expense incurred by railway companies using gas or oil lamps in passenger cars.

This company is a consolidation of all the various companies heretofore engaged in the manufacture and sale of electric car lighting equipments. Its board of directors is composed of some of the most prominent financiers and railroad capitalists in New York city, and its vice-president and general manager, Mr. Jno. N. Abbott, was for many years general passenger agent of the Erie Railroad and subsequently for several years chairman of the Western Passenger Association, in Chicago. The axle light equipment of electric lights and fans is steadily growing in favor and in use on leading railway lines.

A Novel Telephone Transmitter.

A novel type of telephone transmitter is depicted in the accompanying illustration. It is known as the Herald transmitter, and is manufactured by the Herald Transmitter Company, New York city. The design of the instrument is novel and the finish is burnished aluminum, it will not pack or fry and is hermetically sealed. The makers state that it may be submerged for a considerable period without detriment. Objectionable odors and the harboring of disease germs are prevented by a perfect circulation of air through the front part of the transmitter. It is easily installed and will fit into any Erricsson back. Considerable ability has been shown in the design of this instrument, which the makers believe will meet with considerable favor.

An Electric Cooking Oven.

Few people, other than the cook, realize how important in culinary operations is the oven. From the muffin at breakfast to the pastry at dinner, all of the products of flour and roasts and innumerable items of food by which we live and through which we enjoy ourselves are cooked entirely in the oven. It is only lately that the perfection of oven operation achieved by the use of the electric oven have been fully realized. The accompanying illustration represents an electric oven manufactured by the Simplex Electrical Company, of Cambridgeport, Mass., and intended to absorb, as a maximum, 1,500 watts. The machine is finished in Russia iron and has an indicating thermometer, well shown in the illustration, in its door. It has one compartment with a removable shelf and is 11 by 13½ by 17 inches inside. The three switches shown in the base give a combination for three temperatures. In common with other electric heating devices, it is independent from all other things, requiring no chimney, and may be put anywhere—on the floor, for example, or on a table. No heat escapes from it to affect the temperature of the room. This is only one of the many electrical cooking devices manufactured by the same concern.

An Electric Cooking Oven.

Plans were filed with the Building Department of New York city recently by A. W. Porter, architect of the Metropolitan Street Railway Company for the alteration of the old car stables of the Eighth avenue surface road, at Forty-ninth and Fiftieth streets, into an electric power house and storage stable at a cost of $35,000. Half of the building will be used for the storage of cars.

PERSONAL.

Mr. Fred A. Scheffler, well known in engineering and electrical circles, has recently allied himself with the established house of James Beggs & Company, 9 Dey street, New York city. The company is the manufacturer's agent for boilers, engines and allied machinery, and Mr. Scheffler's connection will undoubtedly prove of mutual advantage.

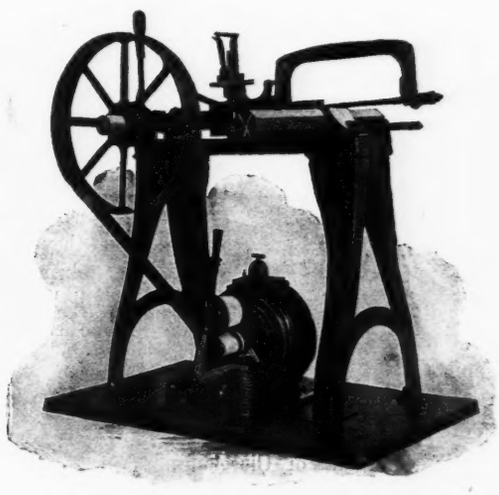
Mr. L. B. Stillwell has resigned as electrical director of the Niagara Falls Power Company, and Mr. Harold W. Buck has been appointed to the position. Mr. Stillwell, it is announced, will open an office as a consulting electrical engineer in New York city, he having devoted much time recently to this branch of the profession, and having now under construction as consulting engineer, the electrical plant of the Manhattan Railway Company. Mr. Buck is a graduate of the Sheffield Scientific School, of Yale University, and of the electrical engineering course of Columbia University. He has been engaged for the last five years in the Schenectady shops of the General Electric Company. Among other changes announced at the Niagara Falls Power Company's plant are the promotions of Assistant Superintendents Paul M. Lincoln and Philip B. Barton, the former having been made resident electrician and the latter superintendent of the operating department.

A Westinghouse Dividend.

The Westinghouse Electric and Manufacturing Company has declared a quarterly dividend of one and three-quarter per cent on its preferred stock payable October 1. Transfer books close on September 20 and open October 2.

An Electric Hack Saw.

In the illustration herewith is shown a hack saw outfit operated by an alternating-current motor for 7,200 alternations. The outfit is manufactured by the Emerson Electric Manufacturing Company, of St. Louis, who have designed it for use in all places where metals require to be cut. The manufacturers state that with this outfit metal cutting can be done at less than one-tenth the cost of doing the same amount of work by hand, or on the shaper. The design of the device has been towards simplicity, reliability and efficiency, the whole outfit is self-contained, and can be used in any location where it is possible to procure the necessary current for the motor. The outfits are made in several sizes and can also be furnished, equipped with direct-current motors. The makers have issued a bulletin fully describing the device.



An Electric Hack Saw

The extensive demand in Cape Town for iron posts for railroad lines, telephone and electric companies generally has prompted Consul-General Stowe at that port to send a diagram of the most used post for the purposes intended. "The demand for these posts," the consul says, "will be large. At the present writing several thousands are needed. England and Germany have been the exporters heretofore, and it is time for United States manufacturers to compete." The consul adds: "Up to the present no American manufacturer has been found who could produce the tapered 'wrought top.' Specifications have been furnished, and invariably the reply has been that only straight tops could be furnished, and I am sending the diagram to the Department in the hope that its publication will meet the eye of some manufacturer who can produce it and is willing to submit prices f. o. b. New York city."

Automobiles

The New York & Ohio Company, of Warren, Ohio, manufacturer of the Packard incandescent lamps and transformers, has gone into the automobile business and is now placing on the market a gasoline automobile.

A newspaper report from Denver, dated September 9, says that Mr. John Brisben Walker has made an ascent of Pike's Peak, in an automobile, of 11,000 feet. He did not finish the trip to the summit as the road was too rough for him.

The New York *Tribune* has inaugurated a voting contest with a steam automobile as a prize. The person to whom the prize will be awarded is the one who shall receive the most votes from other *Tribune* readers. Anyone living in the States of New York, Connecticut, Massachusetts or New Jersey is eligible.

A press cablegram from Paris states that the Fall manœuvres of the French army will have as a feature the many uses to which the automobile is put. The generals have discarded their horses and are using automobiles exclusively. The machines are also being used as transports by the commissary and telegraphic corps, and even for carrying guns which, in many cases, weigh several tons.

Mr. Alexander Winton, of Cleveland, Ohio, has forwarded to Mr. William K. Vanderbilt and Captain Albert Bostwick, of Newport, a challenge for an automobile race at 100 miles, to be decided on a smooth track. As a further incentive a cup, valued at $800 will be given to the winner provided the race is made a feature of the Automobile Exposition to be held at Washington Park, Chicago, September 18 to 22.

All of the silly paragraphs do not start in the American press. A Portuguese paper is authority for the statement that a Russian, rejoicing in the euphonious name of Hutal Serky, has invented a new variety of automobile which he loads up with a two-pound charge of some salt, the composition of which is not stated. When this is warmed it forms a gas which, to quote the original description, "puts the cylinder in movement." It is said that the Czar of Russia has taken great interest in this invention, and intends to send the inventor to Paris. It seems likely that if this is done the inventor will be kept in Paris, as people who can make high pressures and large motive powers from two pounds of salt are not very popular in the Muscovite domains.

Mr. Marcus Nathan, general manager of the Automobile Show, which is to be held at Grand Central Palace, New York city, from November 14 to 24, 1900, is issuing some very attractive printed matter, bringing out the advantages which the show will afford to exhibitors. Mr. Nathan says that the exhibitors are disposed to consider together his show and that which will be given under the auspices of the Automobile Club, at Madison Square Garden, from November 3 to 10. Both shows, the one at the Grand Central Palace following the other, will give automobile manufacturers an uncommon opportunity to meet the people of the East. As is well known, the Horse Show will occur at Madison Square Garden during the Automobile Show at the Grand Central Palace, and it is estimated that 50,000 visitors come to it from out of town each year. These people are naturally of a class interested in automobiles, and it is expected that a very large proportion of them will visit the Grand Central Palace while they are here. Space is being rapidly taken, and Mr. Nathan expects that he will have the largest and best automobile show ever held in the United States.

Automobile Racing at Newport.

The first race-meet of the New York Automobile Racing Association, was held September 6, at Aquidneck Park, near Newport, R. I., about 9,000 persons being in attendance. The first championship of America was won by Mr. W. K. Vanderbilt, Jr., using a French racing machine.

There were no accidents, although there had been some apprehension that there might be on account of the high speed at which the machines would run. The track was very dusty, and many elaborate costumes were spoiled on this account. The first race for electric vehicles had only three entries. The results of the various races run were as follows:

Electric Vehicles—First heat—Won by Mrs. Herman Oelrichs by default. Second heat—Won by A. L. Riker, 10 minutes 44 seconds; S. C. Crane, 10 minutes 52½ seconds.

Final Heat—Won by A. L. Riker. Time, 13 minutes 5 seconds. Mrs. Oelrichs did not finish.

Motor Tricycles—First heat—Won by A. K. Skinner, 10 minutes 30½ seconds; J. Boise Lote, 11 minutes 40 seconds, second; Harold S. Vanderbilt, not timed. Second heat—Won by Charles S. Henshaw, 9 minutes 52 seconds; Royal Phelps Carroll did not finish.

Final Heat—Won by Skinner. Time, 9 minutes 12 seconds. Henshaw did not finish.

Steam Vehicles—First heat—Won by S. T. Davis. Time, 10 minutes 45½ seconds; John Jacob Astor did not finish. Second heat—Won by J. H. McDuffee, 10 minutes 56 seconds; George I. Scott, 14 minutes 16 seconds, second.

Final Heat—Won by McDuffee. Time, 10 minutes 52 seconds. Davis broke down at the start.

Gasolene Vehicles—First heat—Won by William K. Vanderbilt, Jr. Time, 8 minutes 58½ seconds; Fisher, 13 minutes 23½ seconds, second. Second heat—Won by H. Bishop by default.

Final Heat—Won by Vanderbilt, 8 minutes 53½ seconds; Bishop, 9 minutes 30 seconds. Championship Race—Won by W. K. Vanderbilt, Jr., gasolene, 8 minutes 54 seconds; A. K. Skinner, motor tricycle, 9 minutes 22 seconds, second; A. L. Riker, electric, 10 minutes 28½ seconds, third; McDuffee, steam, did not finish.

Telephone and Telegraph

Work will begin soon on the completion of a telephone line from San Angelo to Ballinger, Tex., there to connect with a line to be built thence to Brownwood, which will connect San Angelo, telephonically, with the world.

President Glidden, of the Erie Telephone system, estimates that the Erie company's loss through the Galveston cyclone will be about $50,000. About 10 miles of long-distance telephone wire between Galveston and Houston were wrecked.

It is reported that the Diamond State Telephone Company, of Delaware, expects to extend its lines over the entire peninsula. It covers at present the whole state of Delaware, and is complete to Easton, Cambridge and Denton, Md., and as soon as possible it will be extended down the peninsula through Salisbury to Cape Charles City, Va. At present there are about 400 miles of service, and when completed it will have nearly 1,000 miles.

The Central District and Printing Telegraph Company, of Pittsburgh, Pa., has had plans drawn for a 20 by 40 foot, three-story addition to its east end building, at Centre and South Highland avenues. The entire building, together with the present structure, will be made fireproof. Alden & Harlow, architects, are drawing the plans for the new 10-story building of the company to be erected at Fourth avenue and Cherry alley. The contract for the building will be let in about a month.

International Association of Municipal Electricians.

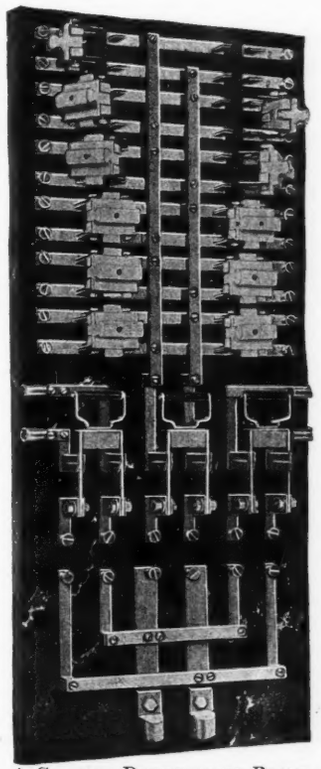
The work of the local committees, in preparing for the fifth annual meeting of the International Association of Municipal Electricians, to be held in Pittsburgh, September 25, 26 and 27, is progressing most satisfactorily. A meeting of the committee on arrangements was held in Allegheny recently, and the following were added to the committee on arrangements: C. B. Gorsuch, division operator, of the Baltimore & Ohio Railroad Company; C. M. Sheaffer, division operator, of the Pennsylvania Railroad Company; J. R. Smith, division operator, of the West Penn Railroad Company; C. E. McKeim, superintendent of telegraph of the Pennsylvania Company; W. D. Painter, superintendent of the Central District and Printing Telegraph Company, and R. J. Daley, inspector of the Pittsburgh Board of Fire Underwriters.

The committee then took up the work of completing arrangements for the entertainment of the visiting delegates and their friends. The trolley ride, on the evening of the 25th, over the lines of the traction companies, will afford the visitors unique views of the two cities by night. These will be obtained from a half dozen points on the bulwark-like hills which envelop Pittsburgh and Allegheny. The view of the cities at this time from Troy Hill, Allegheny, or Mount Washington, Pittsburgh, is most beautiful.

The carriage rides for the ladies over the boulevards and through the parks on the afternoon of the 26th will also be a most enjoyable affair. The east end boulevards (Grant and Beechwood), are many miles in length and run through the most beautiful and picturesque sections of the city. Schenley Park, which is filled with macadamized driveways, has magnificent natural scenery. Highland Park, connected with that of the Schenley by boulevards, commands a view that is unsurpassed anywhere. From it can be seen portions of the two cities united by bridges over the Allegheny River; valleys and uplands alternating in field and forest, and a prospect of the country encircling the eastern portions of Pittsburgh and Allegheny. Beneath can be seen, on the river bank, the celebrated Brilliant Pumping Station, whose engines force daily 40,000,000 gallons of water into the Highland Reservoir, 365 feet above. This reservoir has a capacity of 120,000,000 gallons. A delightful luncheon will be served by the ladies' reception committee in one of the many cozy nooks of one of the parks during this outing.

In the evening theatre parties will be given for those who desire to attend, and for those who care to see them, an inspection of some of the large iron and steel mills will be made.

The crowning pleasure event of the convention, however, will be the excursion and banquet on the steamer Mayflower, down the Ohio River to Davis Island Dam, seven miles and return, then up the Monongahela River, 45 miles and return,



A Compact Distributing Board.

on the afternoon and evening of the 27th. The Tariff Club Quintet, C. F. Harris, manager, and H. P. Ecker, city organist, of Allegheny, will furnish music for the occasion. On this trip a beautiful view of the confluence of the Monongahela and Allegheny Rivers forming the Ohio will be obtained, and of the magnificent bridges which span those rivers. Around what is known as "The Point," cluster at this season of the year, coal fleets aggregating upwards of 10,000,000 bushels of "black diamonds," ready to be towed south when a "barge stage" comes along. Old Fort Du Quesne is still standing near "The Point," and may be seen.

The ride up the Monongahela River will be most interesting and instructive. From the junction of the two rivers to Lock No. 1 will be seen many of the largest mills and factories. Further up the river, on the right, at Homestead, is the Carnegie works, where the great strike of 1892 occurred. Then comes Braddock, the scene of the historic battle between General Braddock and the Indians, in which the former was defeated and killed. Duquesne, McKeesport, Elizabeth, Monongahela City, Glassport and dozens of other flourishing towns will be passed, all of which have some historic interest as well as many great works and factories. The local committee will take especial care and pains to point out and explain the points of interest along the trip to the visitors.

Another American Manufacturer Wins Paris Exposition Medals.

The Holophane Glass Company, 1 Broadway, New York city, has been informed by its Paris representative that the exposition authorities have awarded to it two gold and one silver medals for its various exhibits at the Exposition. It will be remembered that the holophane glass globes are used on the lamps decorating the Electrical Palace, and in several other places in the exposition.

Wireless Telephony.

At the session of the physical science section of the British Association for the Advancement of Science, at Bradford, England, last Saturday, Sir William H. Preece made the interesting announcement that he had found it possible to convey audible speech six to eight miles without wires. So far no details have been received as to the method employed but it is understood that it is similar to the induction telegraph and telephone experiments with which Sir William Preece's name has been prominently identified in the past.

A Compact Distributing Board.

In the accompanying illustration is shown one of the many types of panel or distribution boards manufactured by Zimdars & Hunt, New York city. This firm was a pioneer in this line and has made a leading specialty of this kind of work from the very first. The result is that its manufactures are to be found in the most up-to-date plants in all parts of the United States as well as in many foreign installations. A prominent feature of all the Zimdars & Hunt panel boards is the superior grade of workmanship expended on them. This, together with the simplicity of materials used and their construction, explains the high reputation, the company's work has obtained.

Corporation News

SAN ANTONIO, TEX.—The Dubinski Electric Company filed a deed of assignment August 30.

STAUNTON, ILL.—The Staunton Telephone Company has been organized. Capital stock, $2,500; incorporators: C. R. Wall, S. P. Williamson and C. Godfrey.

NEW YORK CITY—Cook Electric Company, of New York city. Capital, $10,000; directors: S. S. Cook and Martha A. Cook, of Long Island City, and David Mason, of New York city.

NEWARK, N. J.—The Standard Auto-Vehicle Company has filed articles of incorporation. The authorized capital is $250,000. The company will manufacture vehicles and motors.

DANVILLE, ILL.—The Westville Electric Light and Power Company, of Danville, has been incorporated. Capital stock, $20,000; incorporators: Michael Kelly, M. W. Kelly and Edward J. Kelly.

CLINTON, ILL.—The Citizens' Electric Company, of Clinton, has been incorporated, capital $15,000, to operate electric light, heat and power plants; incorporators: E. S. Nixon, Titus Hinchliffe and W. W. Newman.

LACONIA, N. J.—The Laconia Manufacturing Company has been incorporated to do a general electric business. Capital, $500,000; incorporators: G. B. Morton, W. H. Carey, C. Sickelman; G. B. Morton, attorney; all of Jersey City.

LEADVILLE, COLO.—The Leadville Gas and Electric Company, of Leadville, Lake County, has been incorporated with a capital of $200,000; John F. Campion, Robert B. Sullivan, Gilbert Wilkes and C. K. Boettcher are the incorporators.

LOUISVILLE, KY.—Articles of incorporation have been filed by the Central Electric Company, with a capital stock of $10,000; the incorporators are: J. S. Carill, P. M. Gelatt and W. C. Hines. The company will manufacture electric supplies.

HAMILTON, TENN.—The Secretary of State has granted a charter to the Reed Automatic Trolley Head Company, of Hamilton County, with $1,000 capital stock. The incorporators are: E. M. Smith, E. S. Reed, W. P. McClatchy, Harry Preston and W. C. Shelton

CAMBRIDGEPORT, MASS.—The Simplex Electrical Company, of Boston, has filed a certificate with the Secretary of the Commonwealth, announcing an increase in its capital stock from $250,000 to $350,000. The increase was used to purchase new buildings and additional real estate.

PORTLAND, ME.—The Vermilion Railway and Light Company, of Portland, Me., has been incorporated to do a general railway and electric light business. Capital, $1,000,000; incorporators: G. Burnham, Jr., G. F. Duncan, E. Woodman, N. Clifford, P. G. Broun, all of Portland, Me. Flournoy, Price & Smith, attorneys, Charleston.

CHARLESTON, W. VA.—The American Duplex Telephone and Telegraph Company, of Charleston, has been incorporated to do a general telegraph and telephone business. Capital, $1,000,000; incorporators: J. E. Scraggs, E. L. Wood, C. R. Burdette, A. H. Wilson, Jr., J. E. Chilton, all of Charleston; Chilton, MacCorcke & Chilton, attorneys, Charleston.

SCHENECTADY, N. Y.—The Niskayuna Power Company has been incorporated to build and maintain canals in Schenectady and to lease and sell power developed from the flow of water. The capital is $100,000 and the directors are: William A. Graves, of Rexford Flats, and Ernest C. Brown, William H. Fritchman, Henry K. Landis and Leslie J. Montgomery, of New York city.

DENISON, TEX.—The charter of the Denison & Sherman Railway Company has been approved by the attorney general. Capital stock, $100,000. The purpose of this corporation is to build an electric line eight miles long between the two cities named and extending five miles within the limits of both. Incorporators: A. G. Moseley, Tom Randolph, E. J. Smith, J. W. Blake and others.

WARSAW, IND.—With a capital stock of $30,000 a new organization, known as the Commercial Telephone Company, of Warsaw, has filed articles of incorporation, having purchased from the Warsaw Telephone Company its local system and all its toll lines which connect 48 points in northern Indiana, Warsaw being the central station. The incorporators are Strauss Brothers, Ligonier, Ind.; John J. Wideman, Odell; C. W. Burke, Silas W. Chipman, Charles E. Wahl and Mel. R. Williams, of Warsaw.

NEW YORK CITY—It is announced that the reorganization of the Electric Pneumatic Company is progressing favorably, and it is expected that within a few days the property will be turned over to a new company. The plan of reorganization permits the holders of 100 shares of stock to receive 100 shares of stock in the new company. For the assessment of 20 cents per share holders will be given 25 per cent in a bond which shall bear interest at the rate of five per cent per annum. The interest on these debenture bonds must be paid before any dividends are paid on the stock.

The Coming Greatness of the United States

[From the Boston News Bureau.]

The London *Statist*, in a recent issue discusses exhaustively the economic future of America. Assuming that sound money and McKinley will triumph in November, the article says that never before has the position of the United States been better or the outlook brighter. Since 1896 the country has marketed unexampled crops at remunerative prices, and manufacturing has been immensely stimulated. From 1893 to 1896 exports averaged only $850,000,000 per annum; in the past four years the average has been over $1,200,000,000. From 1893 to 1896 imports averaged $750,000,000; for the past four years only $730,000,000. Thus the net trade balance in favor of the states has averaged over $500,000,000 the past four years, against only $100,000,000 the previous four years.

Beside exports of merchandise, the country is now selling abroad a portion of both its gold and silver production. In the 12 months to June 30, last, net silver exports reached $21,000,000, and gold $5,000,000. From 1889 to 1896 gold had to be sent abroad to meet the indebtedness of the United States for interest, freight, insurance and disbursements of tourists. In the past year, however, exports have supplemented American investments abroad —America has been able to buy a very large quantity of its own securities in Europe, to leave a large sum for employment in England, Germany and Russia, and has supplemented the balance due to it by gold shipments.

Wall Street and the Electrical Stock Market.

There was a slight increase in the activity of the stock market for the current week, but without any material changes in prices. The market was practically controlled by professional traders and no substantial revival of outside interests resulted.

On the New York Stock Exchange, General Electric closed the week at 138 bid and 139 asked, a loss of ⅛ of a point for the week. Metropolitan Street Railway, of New York, closed at 153½ bid and 155 asked, a gain of ¾ of a point for the week. Third Avenue Railroad, of New York, closed at 110 bid and 112 asked, indicating no change for the week. Brooklyn Rapid Transit closed at 54½ bid and 54⅝ asked, a loss of ¾ of a point for the week. Manhattan Railway, of New York, closed at 91½ bid and 92 asked, showing no change for the week. On the Boston exchange, the telephone stocks were not quoted.

On the Philadelphia exchange, Electric Storage Battery, common, closed at 70 bid and no asked price, showing no change for the week. Union Traction closed at 36⅝ bid and 36¾ asked, a loss of ⅛ of a point for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 17 bid and 22 asked, a gain of 2 points for the week. Electric Boat closed at 17 bid and 19 asked, a gain of 2 points for the week.

Wall street, September 1.

Industrial Notes

FRED. M. LOCKE, Victor, N Y., announces that he will send a copy of catalogue No. 5 of Locke's insulators upon request.

PARTRICK, CARTER & WILKINS, Philadelphia, Pa., manufacturers of electrical house goods, are soon to move into a large, new building.

CARLETON ELECTRIC COMPANY, 1133 Broadway, New York, has recently patented in this country and abroad a unique window lock, which operates as a fire alarm.

THE DIAMOND METER COMPANY, Peoria, Ill., is preparing a new design of meter which will be placed before the electrical field some time during the Fall.

ROBERT L. McOUAT, Indianapolis, Ind., successor to Varney & McOuat, dealer in electrical supplies, has the state and local agency for Buckeye incandescent lamps.

THE NEW YORK & OHIO COMPANY, Warren, Ohio, manufacturer of the Packard incandescent lamps and transformers, is sending out a small wall calendar for September.

MR. JOHN T. McROY, New York and Chicago, is out with his monthly calendar blotter for September. This month the blotter carries philosophical verses of interest to all electrical men.

THE SPRAGUE ELECTRIC COMPANY, New York, has issued a bulletin describing the Lundell electric motors for blowing pipe or reed organs. The bulletin is designed for free distribution.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has been appointed general western agent for the new "socket extension tap" and is now engaged in sending out circulars and information regarding the device.

WESTINGHOUSE, CHURCH, KERR & COMPANY, Pittsburgh, have just published a list of plants equipped with the Roney mechanical stoker. The list includes some of the most prominent electric plants in the country.

THE NORTON ELECTRICAL INSTRUMENT COMPANY, with main office and factory at Manchester, Ct., now has the following agents: Kohler Brothers, Chicago, and Newman-Sprinley Company, New Orleans, La.

A. L. IDE & SONS, Springfield, Ill., have issued a supplementary bulletin describing the Ideal four-ported engine for electric light and power service. The bulletin is handsomely illustrated and may be obtained free on request.

ROBBINS & MEYERS, Springfield, Ohio, have now a line of protected type of small motors complete in sizes from one-sixteenth to one-sixth horse-power. These motors are series wound and for use on 110 or 220 volts direct current.

THE ROYAL ELECTRIC COMPANY, Peoria, Ill., has recently received from the press some interesting literature relative to the Royal alternating-current generators and transformers, which it will be glad to send free to inquirers.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is general western agent for Richmondt electro-galvanized conduit. The company has lately gotten out a conduit catalogue which should be in the hands of every electrical worker.

THE H. C. ROBERTS ELECTRICAL SUPPLY COMPANY, Philadelphia, Pa., has accepted the agency for the Adams-Bagnall arc lamps. This supply house reports a most active Summer season, with excellent prospects for Fall activities.

THE HOLOPHANE GLASS COMPANY, New York, has prepared booklets in German, Spanish and French describing its Holophane glass globes for all kinds of lights. The booklets are well prepared and are illustrated in two colors.

JAMES L. ROBERTSON & SONS, 204 Fulton street, New York, have issued a pamphlet entitled "Time is Money," describing their "Tic-a-Toc" automatic grease cup. The device seems to be a very meritorious one and is well described in the booklet.

THE PACIFIC ELECTRIC COMPANY, La Crosse, Wis., manufactures a unique line of adjustable electric light lamp shades in 35 different styles. This company has added a number of new designs to its list this season, and it has a new catalogue ready for distribution.

THE AMERICAN ELECTRICAL HEATER COMPANY, Detroit, Mich., is exhibiting an interesting line of electrical heating apparatus, at the Paris Exposition, which has created favorable comment as being in advance of apparatus of this kind made in other countries.

THE CROSS OIL FILTER, made by the Burt Manufacturing Company, Akron, Ohio, has been selected for the equipment of the Imperial Steel Works, owned and operated by the Japanese Government, and it is said that this plant will probably be the most perfect of its kind in Japan.

THE WARREN ELECTRIC AND SPECIALTY COMPANY, Warren, Ohio, wishes it announced that its interests are not merged into the so-called incandescent lamp trust. This company is the manufacturer of the "Peerless" incandescent lamps, transformers and fan motors, and operates a large factory.

SCHIFF, JORDAN & COMPANY, New York, manufacturers of the "Ship" imported carbons for enclosed arc lighting, report the greatest demand in their history for carbons for electric lighting purposes. This company also states that it has orders in hand sufficient to cover its importations for the next 90 days.

THE AMERICAN STONE CONDUIT COMPANY, Chicago, Ill., is placing on the market a stone conduit made of cement and crushed stone. It is claimed that for underground subway systems this conduit is indestructible, as it is a solid block of stone, without joints, although it may be readily sawed to desired lengths and angles.

MOLONEY ELECTRIC COMPANY, St. Louis, Mo., speaks of a very prosperous season and large sales of the Moloney transformers. This company claims that a Moloney transformer of 20-light size or 40-light size will carry a heavier load without burning out than will a transformer of the same size of an oil-insulated type.

THE CAHALL SALES DEPARTMENT, of Pittsburgh, has issued the fifth edition of the Cahall boiler catalogue, which takes the form of a very handsome book, bound in cloth and elegantly illustrated. Various points of advantage claimed for the Cahall boiler are effectively made. The catalogue may be had free on request.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, of St. Louis, has issued a bulletin illustrating and describing its complete electric water-pump outfits, equipped with alternating-current motors. Those interested in this phase of the application of electric power may obtain the bulletin free on request by asking for No. 3018.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued a very handsome booklet entitled "Transformer Testing for Central Station Managers." It is of the most practical character and is carefully illustrated with diagrams and half-tones. The booklet is a handy one to have around and should be in the hands of all interested in transformer work.

THE SAFFORD ARC LAMP MANUFACTURING COMPANY, Buffalo, N. Y., is introducing the improved Safford arc lamp for all currents. A number of interesting features are claimed for these lamps, and electric light stations and those following lighting subjects would be interested in seeing a copy of this company's illustrated pamphlet.

"USEFUL LIGHT" is a title of a booklet issued by the Shelby Electric Company, Shelby, Ohio, from its own press, in which a great deal of information is given about the new Shelby incandescent lamp, which, the manufacturers claim, gives more useful light than any other now on the market. The pamphlet is well worth careful study and may be obtained free on application.

THE WHEELER CONDENSER AND ENGINEERING COMPANY, 120 and 122 Liberty street, New York, manufacturer of the Barnard fanless self-cooling water tower, has had encouraging and gratifying success with this valuable adjunct of steam engineering plants. It will be remembered that in a recent number of the ELECTRICAL REVIEW the Barnard tower was described and illustrated.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., is making a special guarantee that Columbia lamps will be found absolutely uniform in initial readings for candle-power, voltage and efficiency, and particularly requests, in connection with Fall activity for central stations and isolated fields, that consideration be given to claims made for the superior quality of Columbia lamps.

WILLIAM ROCHE, 42 Vesey street, New York, inventor and manufacturer of the "New Standard" dry battery, is placing on the market a dry battery outfit known as the auto-gas battery for gas and gasoline engines, which is particularly designed for use on automobiles. He has also manufactured a unique electrically-lighted campaign button. These specialties are unusually desirable for supply houses.

HEWITT-LINDSTROM MOTOR COMPANY, Chicago, Ill., on a recent test of one of its delivery wagons just finished, weight, 3,200 pounds, radius 50 miles on one charge at a speed maximum of 12 miles, took 15 amperes at 92 volts. At that speed, after running two hours the voltmeter read 92 volts. On a macadam road it is claimed never to take over 17 amperes, and 92 per cent efficiency is claimed for this vehicle.

THE L. B. ALLEN COMPANY, Incorporated, Chicago, in its announcement in this issue, sums up, in condensed form, some excellent reasons why its Allen soldering paste has secured such popular favor among electricians. The paste, being packed securely and neatly in an air-tight tin can (not too deep) assures convenient and safe handling. Its non-corrosive feature creates a strong sentiment in its favor while the effectiveness of this paste is "the proof of the pudding."

MR. H. E. PLASS, of the H. E. Plass Electric Supply Company, 21 Barclay street, New York city, left for a five weeks' trip through the middle west, St. Louis, New Orleans, etc., selling novelties and staples of his own manufacture, of which he has, at present, an extensive line. Mr. Plass also is just bringing out a new and very comprehensive catalogue of electric novelties. The catalogue will be ready for distribution in about two weeks, and any one interested may have a copy by asking for it.

MR. JOHN GRIER, 141 South Clinton street, Chicago, who is the western representative for the Dicke Tool Company, informs the ELECTRICAL REVIEW that his company has received a bronze medal for tools exhibited at the Paris Exposition. This is the highest prize awarded for tools and naturally its recipients are feeling that they

have received very high appreciation. Mr. Dicke was in personal attendance at the Paris Exposition, and his exhibit created considerable interest among foreign manufacturers.

CHAS. A. SCHIEREN & COMPANY, New York city, the well known belt manufacturers, have received from the Paris Exposition the gold medal for leather belting and belting leather. This is a high compliment to an American manufacturer. The firm of Chas. A. Schieren & Company is doing an exceptionally large export business in its well known lines of leather belting for electric power stations, and other services. The company will be glad to correspond with inquirers for this class of goods.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati and New York, manufacturer of dynamos and motors, is in receipt of the following letter from George A. Fuller & Company, of New York, which company made an exhibit at the Paris Exposition: "Your dynamo forms a prominent part in our exhibit, and helped to obtain the grand prizes and gold medals which have been awarded to this exhibit." The Bullock Company has been awarded the gold medal for electrical apparatus exhibited at the Paris Exposition.

"ELECTRIC POWER" is the title of a handsome catalogue just prepared by the Westinghouse Electric and Manufacturing Company, of Pittsburgh. The book is intended for distribution at the Paris Exposition, and is printed in four languages: French, English, German and Spanish. It includes a collection of views of Westinghouse motors applied to stationary service. The object of the book is to tell by pictures rather than words of some of the many ways in which Westinghouse motors are used. The typographical character of the book is beyond reproach.

THE EUREKA ELECTRIC COMPANY, Chicago, Ill., manufacturer of telephone and switchboard apparatus, has just issued a letter to the trade announcing that it has added to its switchboard and telephone business a department of telephone construction supply material, and that it will carry in stock Eureka galvanized telephone wire, extra B. B. B. B. galvanized standard telephone wire, rubber and weatherproof covered wire, annunciator, office and switchboard wire, cross arms, brackets, pins, oak and locust, lag screws and bolts, insulators, knobs, braces, guys, hangers and everything necessary to the equipment of exchanges.

ONE OF THE MOST PROFITABLE post offices in the United States is that at Scranton, Pa. The volume of business is unusually large and is steadily increasing, the figures for the first six months of the present year showing more than double the business for the same months in 1893. This is due principally to the rapid growth of the International Correspondence Schools. Seven years ago the school's postage was barely five per cent of the total, but now one-third of Scranton's postage is paid by the International Correspondence Schools. Their postage has increased from an average of less than $400 to over $5,000 a month.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, of Chicago, informs the ELECTRICAL REVIEW that its new departure of soliciting and receiving orders for the equipment of small exchanges is meeting with marked success. The high class of work installed by the company in the larger exchanges and the successful operation of its many forms of telephone apparatus and appliances for several years is an indication of what may be expected in future installations of smaller nature. The company has recently added to its plant to such an extent that it can now take orders for anything in the telephone line from a part of a single instrument to complete equipments for the smallest or largest exchanges. By complete is also meant the outside line construction, if so desired by customers. The advantage of having one company responsible for an entire installation is obvious. This feature of its work has seldom, if ever, before, been attempted by any other company. A handsomely illustrated circular, descriptive of its manufacturing facilities and products, has recently been issued and will be sent upon application.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburgh, has prepared a booklet entitled "Drop in Alternating-Current Lines," by Ralph D. Mershon. It is supplemented by a brief description of the Westinghouse type F compensator. The first section of the books treats of a method for calculating the drop in alternating-current circuits. The information is given in very good form and should be of value to engineers who have such calculations to make. Any one interested in alternating-current work may receive a copy of the booklet by applying to the company's office at Pittsburgh.

THE VERY EXTENSIVE APPLICATION of the "Chloride Accumulator" manufactured by the Electric Storage Battery Company, of Philadelphia, is indicated by the following list of some of the concerns which have contracted for "Chloride Accumulator" batteries during the past two or three months: Railway Plants—Pawtucket Valley Electric Street Railway Co., Providence, R. I.; Brooklyn Heights Railroad Company, Brooklyn, N. Y.; Boston & Maine Railroad Company, Boston, Mass.; Potomac Electric Power Company, Washington, D. C.; Metropolitan Street Railroad Company (increase), Washington, D.C.; Brightwood Railroad Company (increase), Washington, D C.; Rhode Island Suburban Railway Company, Providence, R. I.; Bellows Falls & Saxton River Street Railway Company, Bellows Falls, Vt.; Detroit Citizens' Street Railway Company, Detroit, Mich.; Union Traction Company (sixth plant), Philadelphia; Sea View Railroad Company, Wickford, R. I.; Stillwater & Mechanicville Railroad Co., Mechanicville, N. Y.; Glens Falls, Sandy Hill & Fort Edward Street Railway Co., Glens Falls, N. Y.; Biddeford & Saco Street Railway Company, Biddeford, Me.; Portsmouth, Kittery & York Street Railway Company, Portsmouth, N. H.; Newton & Boston Street Railway Co., Newtonville, Mass.; New York, New Haven & Hartford R. R. Co., Forestville, Ct.; East Providence, R. I.; Brayton, R. I.; Waterville & Fairfield Railway and Light Company, Fairfield, Mass.; Keene Electric Railway Company, Keene, N. H.; Buffalo Railway Company, Buffalo, N.Y. (Eagle street, second battery); Cold Spring (third battery); Cold Spring (increase); Eagle Street (increase); Slack & Brother, Springfield, Vt.; Metropolitan Street Railway Company, New York City; American Railways Company, Joliet, Ill.; Lemont, Ill.; Spring Forest, Ill.; Boston Elevated Railway Company, Boston, Mass.; Dayton & Northern Traction Co., Dayton, Ohio, Brookville Battery, Arcanum Battery; Indianapolis Street Railway Co., Indianapolis, Ind.; Union Railroad Co. (increase), Providence, R. I. Central Station Lighting Plants—Georgia Electric Lighting Company, Atlanta, Ga.; Edison Electric Illuminating Co. of Boston, Boston, Mass.; Cincinnati Edison Electric Co., Cincinnati, Ohio; Detroit Edison Company, Detroit, Mich.; Indianapolis Light and Power Company, Indianapolis, Ind.; Narragansett Electric Lighting Co. (increrase), Providence, R. I.; Hamilton Electric Light & Cataract Power Co., Hamilton, Ont.; Cleveland Electric Illuminating Co. (increase), Cleveland, Ohio; Edison Electric Illuminating Co., Brooklyn, N. Y.; Pawtucket Electric Co. (increase), Pawtucket, R. I.; Ediison Electric Illuminating Co. (14th battery), New York city. Isolated Plants—Brooklyn Disciplinary Training School for Boys, Brooklyn, N. Y.; Lying-In Hospital, New York city; Mrs. F. W. Scoville (increase), Chapinville, Ct.; Joseph Milbank, Greenwich, Ct.; Howard Willets, White Plains, N. Y.; M. C. D. Borden, Red Bank, N. J.; R. C. Hooper, Manchester, Mass.; Kinney Apartment House, New York city; E. S. Isham, Manchester, Vt.; Astor Apartment House, New York city; Eddy Manufacturing Company, Middletown, N. Y.; United States Government, Fort Totten, N. Y.; C. H. Mackay, Roslyn, L. I.; Mrs. M. V. Clark, Pomfret, Ct.; Westinghouse, Church, Kerr & Co., New York city.

Sixty Years of Club Life.

Electrical men were out in force at a clambake given by the Olympic club at its home at Bay Shore, L. I., Saturday afternoon, September 8. This social organization, famous for its hospitality, has been in existence sixty years, and no more attractive spot exists on the shores of Great South Bay than is to be found at its several club houses and shady grounds.

The attendance of members and guests numbered about two hundred, and the bake, which was opened at four o'clock, proved to be of exceptional quality, and in the judgment of many old clam eaters present had never been excelled by any of the famous bakes of Rhode Island.

Mr. James Kempster, president of the club, welcomed his associates and their guests with a few eloquent words, and while speech making was eschewed, Captain Charles D. Sigsbee, U. S. N., responded entertainingly to a toast to himself and the navy, stating that he intended to make it his earnest purpose to introduce clam eating into the diet on board warships and throughout the navy.

The Eighth Regiment Band furnished music for the occasion, and when led by one of the club members, Captain James F. Wenman, rendered most attractive music notwithstanding.

Many compliments were bestowed upon President Kempster for the success of the bake and also of a delightful lawn party given for the first time by the club and attended by the ladies of the members, on the previous evening.

The Olympic Club, under the energetic presidency of Mr. Kempster, has filled its membership and now possesses a waiting list. The members Saturday evening testified their appreciation of this excellent condition by marching to and through the residence of the president, adjoining the club house, and giving him a serenade.

Among the electrical gentlemen in attendance were: E. M. Scribner, of Bridgeport, Ct.; C. O. Baker, Jr., U. N. Bethell, Charles A. Scheiren, Jr., and C. R. Bangs, of New York city; W. D. Sargent, F. C. Mason and E. F. Peck, of Brooklyn. Mr. H. L. Shippy, a prominent electrical member of the club, was prevented from being present through absence in Europe.